Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 74.—No. 20. CHICAGO, SATURDAY, MAY 17, 1919. PAGE 775.

Famous Boardwalk at Atlantic City Showing Young's Million Dollar Pier in Background, Scene of Convention.

National Electric Light Association Convention

Stage Set for Forty-second Convention at Atlantic City, May 19-22—Record Attendance Expected—Final Arrangements

ONCE again the National Electric Light Association will assemble in annual convention on a pre-war basis, but under auspices that insure its being the most important and largely attended meeting since the organization of the Association in 1885. After a lapse of two years, during which time the central-station industry in common with all others passed through a most critical and trying experience, the normal activities of the Association have been resumed but with renewed vigor and confidence in the future.

To quote from the last bulletin of the Association: "We are returned to peaceful constructive pursuits. Industry must be rehabilitated. We must begin where we left off for war and work with intensified zeal for those results peace makes possible. The machinery of organized, peaceful effort must be renovated. Steam must be gotten up and high pressure maintained in order that we may continue to serve the public effectively.

"When the order 'go' was given a few months ago with the cessation of hostilities, the officers and committees of the Association got off to a flying starrt, and, as a result, much of the old spirit of progressiveness and productiveness was quickly revived. Today the N. E. L. A. is functioning as of old, and ambitious plans are materializing for early introduction and consummation. It behooves everyone to become inoculated with the renewed spirit of forwardness and success."

For the fourth time in its history the Association will convene at Atlantic City, the previous conventions being held there in 1906, 1909 and last year. The convention will open on Monday, May 19, and will continue throughout Thursday. Headquarters for both convention sessions and exhibits of the manufacturers will be at Young's Million Dollar Pier, where ample facilities have been provided to care for the large attendance that is indicated by the advance registration.

As is usual with the N. E. L. A. meetings, a tremendous amount of work has been arranged for and the schedule of sessions has been planned to give everyone an opportunity to attend as many as possible, although there must necessarily be considerable overlapping.

An unusually strong and comprehensive program has been prepared, covering practically all phases of central-station management and operation. The exhibition will open at 9 o'clock, Monday morning, and the remainder of the day will be taken up with details of registration, headquarters for this being at the main entrance of the Pier. The usual presidential reception will be held in the main ball room at 9:30 o'clock p. m., Monday. Business sessions will start Tuesday morn-

ing, the first being the general and executive session at 10 o'clock. Parallel sessions of the Commercial Section, Accounting Section, Vehicle Section and Technical and Hydroelectric Section will be held at 2 o'clock, and the second Technical and Hydroelectric Section meeting will be held at 2:30. The second general and executive session will be held at 9 o'clock Tuesday evening, this being the public policy session at which an interesting report will be presented. On Wednesday there will be general sessions in the morning and parallel sessions of all sections in the evening. The Company Section and Power Sales Bureau dinner will be held at 6:30 o'clock, and at 9 o'clock will start the carnival, which is the chief entertainment function of the convention. The concluding general and executive session will be held Thursday morning and the meeting will close with a meeting of the Commercial Section, starting at 2:30 p. m.

Entertainment Features.

Final arrangements for the entertainment at the Atlantic City convention of the National Electric Light Association are being made by T. I. Jones, Brooklyn Edison Co., chairman of the Entertainment Committee. The opening entertainment feature will be the reception for President Wells at 9:30 p. m., Monday. Dancing will follow the reception.

On Tuesday from 12:30 to 1:30 p. m. and from 4 to 5 p. m. there will be a demonstration of wireless telephony between the end of the Steel Pier and an airplane exhibit. A tea and musicale for the ladies will take up the hours from 4 p. m. to 6 p. m. In the evening comes the public policy session, followed by dancing, open to all the guests of the convention.

Wednesday morning and afternoon will be given over to a second exhibition of wireless telephony and to a display of aeronautical skill.

The feature of Wednesday's program is to be a grand carnival and ball in which effects of music, light and color, rather than fancy dress are to be stressed. The carnival will begin promptly at 9:30 p. m. and will continue until 10:45 p. m., when there will be an illumination and dance spectacle. Lights of seventeen colors will be used. Bassett Jones will supervise the staging and scenario.

The Entertainment Committee will have headquarters on the ground floor of the Million Dollar Pier, where H. S. Giellerup will be in charge. Delegates should wear their badges to participate in the privileges of the convention.

Industrial-Lighting Demonstration to Be Feature.

The Committee on Industrial Lighting is scheduled to present a brief review of the present average lighting practice in factories and other industrial establishments in comparison with the remarkable results in increased production obtained from some test installations giving true "productive intensities." This material has been obtained by applying the ideas of the Lighting Sales Bureau's lecture at the 1916 convention, "Lighting—a By-Product or Buy-Product." As in the earlier talk by W. A. Durgin, the points are illustrated with a model and demonstrations. The new apparatus shows both the defects of common practice and the principles and advantages of good lighting, in such a simple manner that the facts are easily remembered and applied. Productive intensities are developed as equally attractive to the central station and to its customers. The results of four tests recently conducted in Chicago will also be presented by Mr. Durgin. These show conclusively that by using three or more times the illumination intensities now common there is produced an increase in production of 10 to 20% at an increase in lighting costs forming but a small percentage of the payroll. Work will also be of better quality and less material will be wasted, advantages difficult to capitalize, however.

TENTATIVE SCHEDULE OF SESSIONS

42ND CONVENTION NATIONAL ELECTRIC LIGHT ASSOCIATION

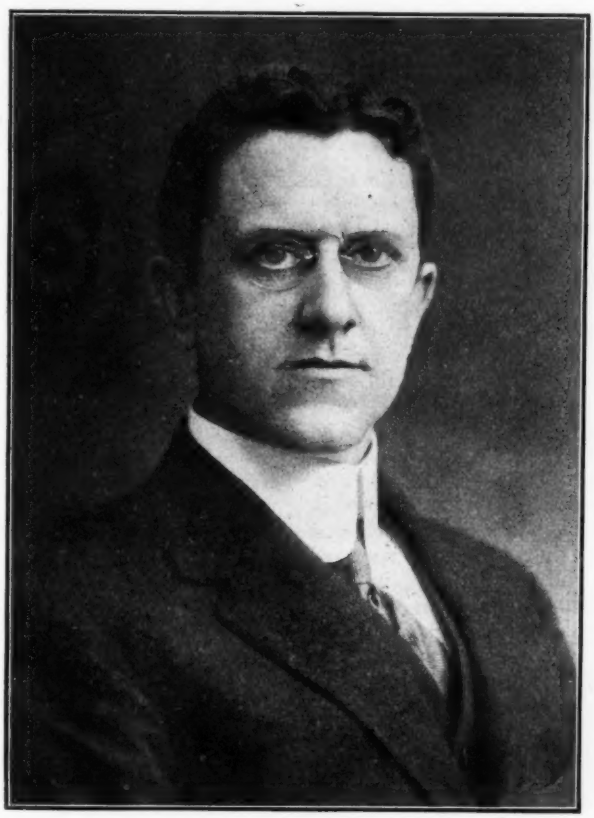
Atlantic City, New Jersey, May 19-22, 1919

	Monday, May 19th	Tuesday, May 20th	Wednesday, May 21st	Thursday, May 22nd
Morning	*9 o'clock* Exhibition Opens Registration Begins	*10 o'clock* General and Executive— Session No. 1	*10 o'clock* General and Executive— Session No. 3	*10 o'clock* General and Executive— Session No. 4
Afternoon		*2 o'clock* Commercial Section— Session No. 1 Accounting Section— Session No. 1 Vehicle Section— Session No. 1 Technical and Hydro-Electric Section— Session No. 1 *2:30 o'clock* Technical and Hydro-Electric Section— Session No. 2	*2 o'clock* Technical and Hydro-Electric Section— Session No. 3 Accounting Section— Session No. 2 Vehicle Section— Session No. 2 Commercial Section— Session No. 2 Commercial Section— Session No. 3 *3:45 o'clock* Commercial Section— Session No. 4	*2:30 o'clock* Commercial Section— Session No. 5
Evening	*9:30 o'clock* Presidential Reception	*9 o'clock* General and Executive— Session No. 2 (The Public Policy Session)	*6:30 o'clock* Company Sections Dinner Power Sales Bureau Dinner *9 o'clock* Carnival	

Statement by President Wells

THE first convention of the National Electric Light Association was called some thirty years ago so that the men engaged in the electric lighting industry could get together and in an open forum discuss ways and means of advancing the art and science of the production, distribution and use of electricity for public service and of overcoming the difficulties incident thereto. A few men attended this first convention. The amount of capital investment they represented was small and the securities of the industry were considered highly speculative by the investing public.

That the objects of the Association have been attained in a remarkable degree and that the industry has developed and assumed an importance, then probably undreamed of, has been evident to all during the past few months. The member companies, principally engaged in lighting in the early days, have developed into the great public utilities of today serving the public for miles around not only with light but with power adaptable for every purpose from the ⅛ kilowatt used by the jeweler to thousands of kilowatts used by shipyards, steel mills and countless manufacturing plants.



Walter F. Wells,
President, National Electric Light Association.

Our advancement in the art and science of the production and distribution of electricity has made it possible to locate factories with regard to the source of raw material, the consumption of the product and the environment of the employes. We have made it unnecessary to locate the mill by the stream, the foundry near the charcoal pit, or the ice house by the pond.

It was the power supply developed by the members of our organization that during the war helped in great measure to make possible the rapid erection and equipment of factories, shipyards and war-supply bases for the production and transportation of the supplies required to send two million men overseas within a year. Our importance was recognized by the Federal Government which granted us priorities in obtaining our coal and equipment needed in the extension of plant. We must now "beat our swords into plowshares and our spears into pruning hooks" for our power is needed for producing farm tractors instead of tanks; it is required for sewing machines instead of machine guns.

The greatest developments of our age have come through team work and perfected organization. The founders and leaders of our Association realized this and long prior to the war had developed an organization and worked out a plan whereby representatives of member companies could learn from others by the interchange of views upon every subject pertinent to the industry. This plan provided for formal assemblies at conventions, meetings of committees appointed for investigations of special subjects and the acquaintanceship of members which makes possible intimate conferences upon any detail of our industry by two or three people particularly interested therein.

During the war our educational activities were curtailed but our country profited by the knowledge previously disseminated by our Association through enlistment and induction into military and naval service of many of our members for duty here or overseas, as well as through commandeering or utilizing the personnel, plants and power supply of our member companies.

Since the signing of the armistice our activities have been fully resumed. Committees have been hard at work and our forty-second convention opening at Atlantic City on May 19, will take up for consideration the subjects leading to the fullest development of the electrical engineering arts and sciences in all their branches and the problems incident to the readjustment and establishment on a peace time basis of an industry in which is invested some three billions of dollars.

[The foregoing statement by President Wells, of course, makes no reference to the intelligent leadership needed in association affairs during the fiscal year drawing to a close, nor to the tremendous amount of work necessary to prepare for the convention. Usually an administration has a full year in which to organize committees and compile the great volume of information presented at the annual convention. This year it was not until after the signing of the armistice that it was known that a convention would be held and it was considerably later before plans were finally consummated. Whatever success is achieved by the forty-second convention will, therefore, be due in large measure to the able leadership of Walter F. Wells and his efficient associates.—Editors.]

Comments by Chairmen of Geographic Sections

IN ORDER to determine the business outlook from the standpoint of central-station companies on the eve of the National Electric Light Association convention, an inquiry was addressed to the president of each geographic section. The following replies received indicate a very satisfactory condition with excellent prospects for the future:

CONDITIONS IN THE NORTHWEST.

By H. J. Gille,

President, Northwest Electric Light and Power Association.

This district was not affected to the same degree by war business as some of the Eastern districts were because there are no ammunition plants located here. The only strictly war industry was the shipbuilding and allied industries. Of course, all other industries, such as lumber, fishing, horticulture and agriculture were operated at high pressure during the war, and still are, except the wood shipbuilding industry, which will probably greatly diminish on account of the fact that the Government has practically cancelled all boat contracts for which the keels have not been laid. The outlook for the lumber and the food-producing industry is very bright indeed. During the war this district suffered considerably because of lack of tonnage, but with the release of vessels by the Government this difficulty will disappear. We, therefore, look forward to a very large increase in the exports and imports with the readjustments to normal conditions.

At the time the armistice was signed, Nov. 11, 1918, there was considerable war business projected in the Pacific Northwest which required large amounts of power. A large part of this business of course did not materialize, but after a short interval other industries of more permanent nature began to make their appearance and the light and power business today is showing a very substantial and healthy growth with prospects excellent for the immediate future.

PACIFIC COAST CONDITIONS.

By Samuel Kahn,

President, Pacific Coast Section, N. E. L. A.

The demand for agricultural power is ever increasing for the reason that more land is constantly being put under irrigation and a substantial portion of this land is watered by means of electrically-driven centrifugal pumps that lift the water from shallow wells.

A revival of the mining activity is again apparent and consequently the public utility companies will be expected to supply a large amount of energy to serve this class of business.

Manufacturing establishments are continuing to increase and their natural motive power is electricity, due partially to the high price of fuel oil, partially to the low price of electrical energy and partially to the convenience of using the latter.

In addition thereto there are the usual domestic and municipal uses for electrical energy which are common to all public service corporations, but in this land of cheap power the energy consumption per capita increases more than the energy consumption per capita in many sections of the United States.

Almost without exception the central stations have been authorized by the Public Utility Commission to increase their rates to meet the unprecedented increases in operating expenses; therefore, with the increased volume of business and increased rates, the utilities of the section should enjoy the prosperity and render the high standard of service that they and their consumers merit, respectively. Generally speaking, the outlook is bright for the utilities in this section of the country.

BUSINESS OUTLOOK IN NEBRASKA.

By J. E. Davidson,

President, Nebraska Section, N. E. L. A.

It seems to be a foregone conclusion that our country will be particularly prosperous for at least two years after the peace pact is signed. It is now believed that we will have unprecedented demands for electric service for power and light purposes. The companies that are progressive along electric merchandizing lines should establish new high sales records. Business is already particularly good in most parts of the country. Earnings of business firms and labor are very high and this should produce prosperity.

We cannot look for a great reduction in the costs entering into operating expenses, therefore the rate regulatory bodies must come to the relief of the majority of public utilities and allow rate increases. This will be necessary in order to make an earning showing that will permit investment in securities to care for public needs.

BUSINESS OUTLOOK IN PENNSYLVANIA.

By Thomas Sproule,

President, Pennsylvania Electric Association.

The business outlook of the light and power utilities throughout the state of Pennsylvania warrants extreme optimism. Our field of vision has new and wider boundaries, our confidence in the value of our goods has greatly increased, hence, our faith in our commercial future is greater than ever before.

The industrial power situation, due to the reorganization of the industry and to the great increase in the competitive cost of generating power, is such that our service is of great economic importance.

The new commercial developments in prospects based on war achievements proven by war necessities, the development of the electric furnace field, the requirements for ice manufacture due to the open winter —all require large amounts of power.

In the western section of the state the maximum peak load of the central stations shows a slight decrease since the signing of the armistice. The potential markets for coal and steel which are controlling in this part of the state are such that it is believed that the central-station industry will be called upon to furnish for their production an increased amount of power in the future.

In the eastern section of the state, the load-factor has fallen off somewhat, but the demands for service are increasing daily, this being particularly true of the comparatively small light and power users. There is every indication that the lessons of the war form an economic standpoint in which central-station service proved one of the most important factors will result in a demand for such service which will tax the utilities to their utmost capacity.

The future, therefore, appears to be particularly bright and while there is no evidence of a decrease in the cost of labor and material in sight, a readjustment of the rates which must come will result in a period of prosperity never before experienced.

Arrangements for the Manufacturers' Exhibit

JUST as the officers of the Association and committee members have striven to make the convention surpass in interest and importance any previous convention, so have the members of the exhibition committee left nothing undone to provide a display of manufacturers' products that will be in keeping with the importance of the convention. Under the guidance of J. W. Perry, chairman, and H. G. McConnaughy secretary, the committee has worked unceasingly arranging for the exhibit and all indications are that their efforts will be well repaid by the result. In this connection it is interesting to note that the number of individual exhibits will be the largest in the history of the Association and likewise the total area occupied will be considerably more than at any previous convention.

H. G. McConnaughy,
Secretary Exhibition Committee.

Details of the arrangements are eloquently summarized in the following notice sent out from Exhibition Committee headquarters.

Five acres of combination ball room, hotel lobby, dance saloon, and exhibition hall, all under one roof—same to be moored off the Atlantic Coast, within easy reach of land.

This is a big order—

Yet this is the specification, so to speak, that the convention committee set up for themselves, as a possible accomplishment.

Now it is an achievement.

It should here be written, into this program, as of historic interest, that this convention occupies the largest home in the history of the Association, and more remarkable is the fact that with all its size, it could still use more exhibition space even after the addition of three thousand square feet to the original twenty thousand square feet allotted to it.

Despite this addition, it was still impossible to accommodate all applicants.

"All under one roof" has always been the spirit of N. E. L. A. conventions, no matter what the actual geography of the respective convening places has been. This year your convention is literally, "all under one roof" and to the convenience and pleasure of all.

The great ball room is flanked with pergolas as a foreground *pia vista* of Italian Gardens, which in turn is the setting in which exhibitors will display their interesting and diversified products. Then there are more garden paths flanked by more exhibits along the way that leads from the Exhibition Hall to Meeting Auditorium.

This is an electric lighting convention, so logically lighting will play an important role. Not only the work-a-day science-service-selling side, which will be shown in abundance, but lighting in Masque and Wig-lighting with the make-up on; playing to your eye and to your sense of the beautiful. Lighting at this convention will count you not only as a craftsman in electricity, but also as a lover of the beautiful and of the artistic.

Lighting will entertain you, the great hall itself, through lighting, will appear in new guise day after day and night after night—for your entertainment and pleasure.

Members of N. E. L. A. Exhibition Committee.

C. L. Peirce, Jr.

Charles Blizard.

J. C. McQuiston.

J. W. Perry,
Chairman Exhibition Committee.

Frank H. Gale,
Treasurer, Exhibition Committee.

The ball room will hardly be recognizable, as between morning, afternoon and evening—what with its complete change in dress-up for business convention, exhibition hall, tea room, theater and finally dance saloon.

So that in the same expanse where in the morning you browse around among the exhibits that are so important from your business point of view, you will in the afternoon be entertained—in a seemingly different place. You will be refreshed at a tea table and dance or laugh three hours later on the same spot where that table stood.

The following is a list of exhibitors with names of the representatives in attendance.

EXHIBITORS' REPRESENTATIVES IN ATTENDANCE.

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.—J. R. Jeffrey, manager, Electrical Department; R. S. Flesheim, special representative; C. E. Searle, general representative, Sales Board; T. J. Lynch, manager, Boston office; E. T. Pardee, manager, New York office; Fred L. Webster, manager, Chicago office; W. W. Power, manager, Philadelphia office; J. E. Wray, in charge of exhibit.

THE AMERICAN CONDUIT MANUFACTURING CO., Pittsburgh, Pa.—D. H. Murphy, C. W. Abbott.

AMERICAN ELECTRICAL HEATER CO., Detroit, Mich.—W. A. Baker, C. M. Blazer, F. J. Johnson, W. A. Scranton.

THE BAKER R & L COMPANY, Cleveland, Ohio.—E. J. Bartlett, New York manager; J. H. Killius, sales engineer; William P. Kennedy, consulting engineer.

BORNE, SCRYMSER CO., 80 South Street, New York.—J. H. Torrey, manager, Turbine Oil Department; James E. Kimball, superintendent of sales.

CAFFIELD MOTOR WASHER CO., Dayton, Ohio.—J. F. Caffield, W. J. Skelton.

CENTRAL ELECTRIC CO., 316-326 Wells street, Chicago.—Albert L. Arenberg, Fred L. Warner, Ralph E. Perry.

COMMERCIAL TRUCK CO. OF AMERICA, 27th and Brown streets, Philadelphia, Pa.—E. R. Whitney, president; F. E. Whitney, treasurer and general manager; R. K. Merrick; A. W. Young, manager, Philadelphia sales office; Martin Melia, garage superintendent.

Members of N. E. L. A. Exhibition Committee.

F. R. White.

J. F. Gilchrist.

S. E. Doane.

GEORGE CUTTER CO., South Bend, Ind.—D. K. Chadborne, G. T. Dunklin, J. R. Townsend.

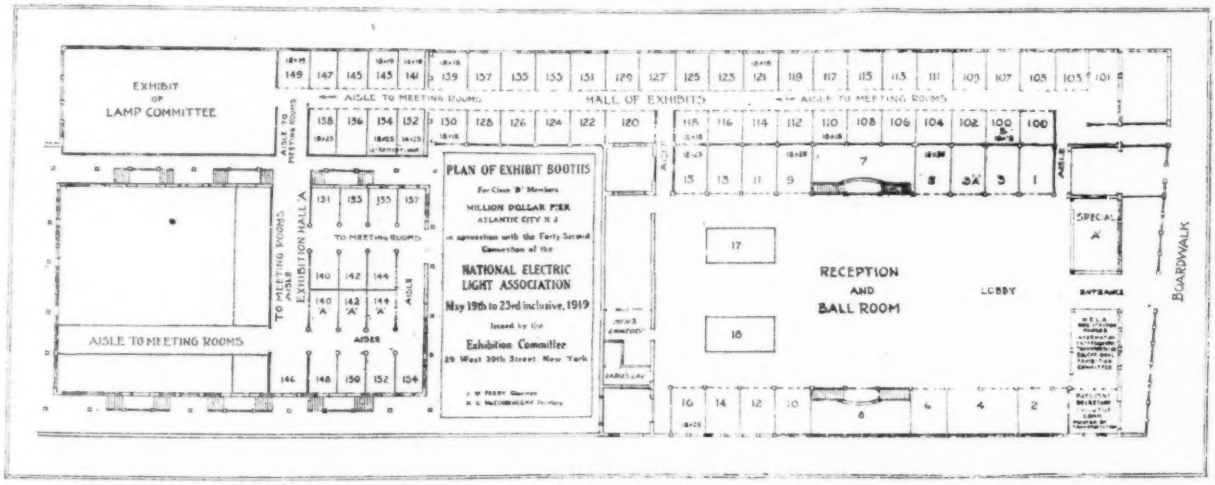
DELTA-STAR ELECTRIC CO., 2437 Fulton street, Chicago.—H. W. Young, president; Alfred Alsaker, consulting engineer.

DETROIT STOVE WORKS, Detroit, Mich.—E. F. Gehrig, research engineer.

EDISON ELECTRIC APPLIANCE CO., INC., 5660 West Taylor street, Chicago.—George A. Hughes, president; J. F. Killeen; J. D. A. Cross, G. E. Division Sales Manager; Walter M. Fagan, sales manager, Hotpoint Division; P. L. Miles, Hughes Division Sales Manager.

EDISON STORAGE BATTERY CO., Orange, N. J.—H. G. Thompson, vice-president and general sales manager; Bertram Smith, assistant general sales manager; George Drake Smith, manager Electric Vehicle Department; John Kelly, manager, New York sales district; Paul Sutcliffe, advertising manager.

ELECTRIC SERVICE SUPPLIES CO., 17th and Cambria streets, Philadelphia, Pa.—J. R. McFarlin, in charge; G. W. Cox, A. M. Knight, E. E. Hedler, F. C. Peck, E. G. McAllister, H. G. Lewis, B. A. Plimpton.



ELECTRIC STORAGE BATTERY CO., Allegheny avenue and 19th street, Philadelphia, Pa.—Herbert Lloyd, president; Charles Blizard, third vice-president; J. H. Tracy and W. V. Brandt, Philadelphia office; H. B. Gay, manager, Cleveland office.

ELECTRIC TESTING LABORATORIES, 80th street and East End avenue, New York.—Preston S. Millar, general manager; F. M. Farmer, chief engineer; E. D. Doyle, assistant engineer; Norman D. MacDonald, assistant to general manager.

ELECTRICAL REVIEW, Chicago, Illinois.—Charles W. Price, president, Howard Ehrlich, managing editor, G. W. Pomeroy, circulation manager, E. L. Rogers, H. W. Young, F. C. Colwell and Harry Gardner.

ELLIOTT-FISHER CO., Harrisburg, Pa.—P. D. Wagoner, president; G. W. Spahr, sales manager; T. O. Grisell, special representative; R. E. Weaver, manager, Public Service Sales Division; F. L. Benedict, eastern district manager; Ralph Trego, Philadelphia local manager; W. H. Repp, Baltimore local manager; J. H. Stange, Washington local manager; A. W. Burdette, J. L. Mellon, G. E. Wengert, C. A. Teal, P. P. Teal, T. C. Campbell and E. S. Massey, Philadelphia salesmen.

EUREKA VACUUM CLEANER CO., Detroit, Mich.—Fred Wardell, president; A. L. McCarthy, general manager; F. J. Saylor, district manager.

FEDERAL SIGN CO. (ELECTRIC), Lake and Desplaines streets, Chicago.—James M. Gilchrist, secretary and treasurer; W. Warren Tower, eastern district manager; D. R. Webb, Jr., manager, Philadelphia office; E. S. Grandin, manager, Baltimore office; J. G. Goldfuss, manager, New York office; W. Ryan, S. S. Davies, C. C. Litzenberg, salesmen, Philadelphia office.

ELECTRIC VACUUM CLEANER CO., Inc., Cleveland, Ohio.—C. S. Bigsby, eastern manager; A. K. Baylor, director; H. J. McDevitt, traveling representative.

GENERAL ELECTRIC CO., Schenectady, N. Y.—E. W. Rice, Jr., president; O. D. Young, J. R. Lovejoy, G. E. Emmons, G. F. Morrison, vice-presidents; T. Beran, A. K. Baylor, J. H. Livsey, J. E. Kearns, F. S. Hunting, E. O. Shreve, A. D. Page, C. W. Stone, D. R. Bullen, F. H. Gale, W. H. Colman, D. B. Rushmore, F. G. Vaughen, J. W. Upp, S. H. Blake, M. O. Troy, C. K. West, F. M. Kimball, G. H. Stickney, A. D. Babson, E. F. Collins, H. R. Summerhayes, E. E. F. Creighton, W. A. Woolford, W. M. Stearns, N. R. Birge, C. A. Corcoran, J. B. Taylor, A. L. Jones, F. V. Gantt, H. H. Barnes, Jr., R. G. Henderson, R. B. Beale, E. D. Payne, E. E. Gilbert, A. H. Abbott, E. E. Peasley, C. A. B. Halvorson, G. C. Osborne, C. A. Winder, R. H. Carlton, H. R. Sargent, G. N. Chamberlain, S. F. Dibble, L. W. Shugg.

G & W ELECTRIC SPECIALTY CO., 7440-52 South Chicago avenue, Chicago.—F. P. Withers.

HOOVER SUCTION SWEEPER CO., North Canton, Ohio.—F. G. Hoover, H. Earl Hoover, W. A. Hawley, F. M. Rhed, J. H. Jones, H. M. Rowley, W. W. Steele, W. G. Farnum, W. Louis Johnson, R. J. Fisher, J. A. Duff, Thomas F. Kelly.

HUBBARD & CO., Pittsburgh, Pa.—C. P. Seyler, vice-president; C. L. Peirce, Jr., manager; W. R. Pounder, western representative; E. Wessel, southwestern representative; N. C. Husted, A. R. Robitzek, R. M. Kerschner, sales manager, Electrical Materials Department.

HURLEY MACHINE CO., Chicago.—Thomas J. Casey, vice-president; Meyer Hurley, vice-president in charge New York office; E. F. Davis, in charge Boston territory.

INDEPENDENT LAMP & WIRE CO., INC., 1737 Broadway, New York.—A. P. Saas, treasurer;

L. Hofheimer, vice-president; A. J. Liebmann, vice-president.

INTERNATIONAL TIME RECORDING CO., 50 Broad street, New York.—H. S. Evans, C. M. Penfield, S. H. Chamberlain.

JEFFERY-DEWITT INSULATOR CO., Huntington, W. Va.—Arthur L. McLeod, general and sales manager; Robert M. Johnston, ceramic engineer.

THE LEEDS & NORTHRUP CO., 4901 Stenton avenue, Philadelphia.—M. E. Leeds, C. S. Redding, C. R. Cary, P. E. Klopsteg, I. M. Stein.

MOLONEY ELECTRIC CO., St. Louis, Mo.—T. O. Moloney, St. Louis; J. J. Mullen, St. Louis; F. M. Tupper, New York; G. D. Leacock, Toronto, Ontario.

NAUGLE POLE & TIE CO., 5 South Wabash avenue, Chicago.—L. E. Morier, eastern sales manager.

THE OHIO BRASS CO., Mansfield, Ohio.—H. A. White, O. G. Calland, E. B. Snyder, A. O. Austin, G. W. Cooper, N. M. Garland, L. A. Wilson, N. Shute, P. S. Corey.

THE PACKARD ELECTRIC CO., Warren, Ohio.—W. F. Parker, sales manager; Capt. J. Ed Erickson, manager, New York office.

PHILADELPHIA ELECTRICAL & MANUFACTURING CO., 1228-36 North 31st street, Philadelphia, Pa.—W. O. Dale, James Fairweather, C. L. Bundy.

PITTSBURGH TRANSFORMER CO., Pittsburgh, Pa.—R. V. Bingay, M. R. Evans, J. B. Harris, Jr., P. H. Butler, C. R. Lininger, M. D. Summers.

RATHBONE SARD ELECTRIC CO., Albany, N. Y.—Clyde A. Flint, sales manager, Albany, N. Y., and Aurora, Ill.; A. L. Smith, Jr., New England representative, Boston, Mass.

REMMERT MANUFACTURING CO., Belleville, Ill.—William Remmert, E. B. Heneks, Detroit Vacuum Cleaner Co.; B. L. Fry.

RUMSEY ELECTRIC CO., 1231 Arch street, Philadelphia.—G. A. Rumsey, B. T. Hare, C. K. Kelley, W. R. Ottey, J. A. Henry, R. Fisher, W. M. Phillips, A. R. Todd, E. B. Brant, A. W. Bannister, J. W. Cryder, E. L. Sholl, W. F. Koehler, H. L. Wagner, J. M. Pratt, D. W. Smith, H. S. Reed, A. O. Veit, G. B. Ward, W. B. Weir.

SANGAMO ELECTRIC CO., Springfield, Ill.—F. C. Holtz, chief engineer; Edward Wray, assistant general manager; C. R. Horrell, assistant sales manager; T. B. Rhodes and W. S. Boult, New York office; H. G. Duus, Philadelphia; S. J. King, Boston; Scott Lynn, Toronto, Ont.

SIMPLEX ELECTRIC HEATING CO., 85 Sidney street, Cambridge, Mass.—E. B. Stebbins, Philadelphia representative; R. P. Wise, New England representative; R. P. Ingalls, sales manager; L. Crocker, manager.

SQUARE D CO., Detroit, Mich.—A. MacLachlan, H. G. Nichols, sales manager, Philadelphia territory.

THE TABULATING MACHINE CO., 50 Broad street, New York.—H. S. Evans, Clement Ehret, William MacLardy, J. T. Wilson.

WADSWORTH ELECTRIC MANUFACTURING CO., Covington, Ky.—George B. Wadsworth, R. J. Dibowski.

WAGNER ELECTRIC MANUFACTURING CO., 6400 Plymouth avenue, St. Louis, Mo.—E. H. Cheney, Brooks Faxon, E. W. Goldschmidt, W. A. Layman, John Mustard, T. T. Richards, W. Robbins.

WALKER VEHICLE CO., 531-545 West 39th street, Chicago.—C. A. Street, general sales manager; G. A. Freeman, vice-president; P. E. Whiting, district sales manager, New York; J. B. N. Cardoza, salesman, New York office.

WESTERN ELECTRIC CO., 195 Broadway, New York.—J. J. Portley, New York; A. L. Hallstrom, Philadelphia; G. T. Marchmont, Richmond; C. D. Cabaniss, Atlanta; J. L. Ray, Pittsburgh; J. A. Janney, Chicago; E. H. Waddington, St. Louis; W. J. Drury, Cleveland; P. L. Thomson, General Department; J. H. Moseley, H. R. Kind, W. Hall, W. W. Templin, G. P. Hessler, F. R. Killion, F. A. Ketcham, G. E. Cullinan, H. L. Grant, New York.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.—H. A. Coles, Mr. Thornwell, Atlanta; G. M. Bates, G. C. Ewint, J. M. Tomb, F. L. Nason, Boston; T. L. Schrantz, C. W. Underwood, Buffalo; T. J. McCill, J. W. Busch, R. Everson, H. A. Lynette, Chicago; J. A. Brett, C. R. Gilliland, Cincinnati; C. C. Owens, Detroit; A. E. Allen, C. E. Stephens, B. K. Mould, W. A. Rossell, C. M. Kirkpatrick, R. R. Kime, E. D. Kilburn, New York; C. W. Woodward, G. Blockside, G. C. Ligon, I. L. Gilkyson, S. E. Wearn, J. D. Myrick, H. L. Moody, R. T. Moon, H. H. Seabrook, Philadelphia; J. McA. Duncan, Pittsburgh; J. S. Tritle, G. F. Leake, St. Louis; J. C. McQuiston, J. Mac. Duncan, C. S. Cook, E. H. Sniffin, I. S. Forde, C. F. Lloyd, H. H. Rudd, W. S. Rugg, W. H. Patterson, C. B. Gibson, R. W. E. Moore, G. I. Gilchrist, M. C. Rypinski, T. J. Pace, T. A. McDowell, W. S. Scott, H. M. Wible, A. C. Streamer, S. A. Berger, J. G. Miles, B. S. Manuel, C. R. Gilchrist, East Pittsburgh.

C. H. WHEELER MANUFACTURING CO., Philadelphia, Pa.—C. H. Wheeler, Jr., G. L. Kothny.

ELECTRIFICATION PLANNED FOR NORTHERN HOLLAND.

Extensive Schemes for Unified Electrification Formulated.

A company is being proposed in the Netherlands to carry out the electrification of the whole of North Holland. It is to be called the P.E.G.E.M. (Provincial and District Electrical Co.), its objects being:

(1) The working of electrical central power stations.

(2) The development and distribution of electric current and anything connected therewith.

The power station will become the company's property, the purchase price being paid for in bonds representing their transfer value.

Only public bodies, according to the *Neiuwe Rotterdamsche Courant*, can become shareholders in the company—in this case the province of North Holland and the towns of Amsterdam and Haarlem. They will be provided with current at cost price, which they will then distribute in their own districts at their own price, and on any conditions they think fit. There is therefore to be one producing concern, connected with three distributing centers.

The capital is fixed at 30,000 gulden, split up into six shares of 5000 gulden each, of which North Holland will take three (15,000 gulden), and Amsterdam and Haarlem two and one respectively. The duration of the company will be for 50 years, but can be prolonged at any moment not later than the 25th year.

Central-Station Service for Ice Making and Refrigeration

Advantages of Electrically Operated Plant Using Raw-Water Process — High State of Development Attained — Tendency to Use Synchronous Motors — Other Interesting Features

By C. J. CARLSEN

Refrigerating Engineer, Commonwealth Edison Co., Chicago.

IN making cost comparisons between pre-war conditions and those of today we invariably give blame or credit to "the war." In this article dealing with the tremendous growth of central-station service for ice and refrigeration work, both large and small, we will do neither. We are going to claim outright the full 100% of credit for the central station.

For in what way could the war have affected the high cost of maintenance and repairs on steam, gas, or oil-driven equipments as compared with the low repair cost of equipment for electrically operated ice-making or refrigeration plant? The items to compare are labor and material, which would be common to all types of prime movers, differing only in frequency and extent of such repairs. Neither could the war have had anything to do with the disagreeable noise and odor from such plants that would cause an entire community to rise in protest and compel a change in method of operation and this invariably has led to electric drive. Nor will we be able to blame the war for the weather conditions for the winter of 1918-1919 whereby the natural ice harvest for the year was a complete failure.

Yet these are the three predominating conditions that have caused the great change in preference for electrically driven plants. And right here is where the 100% claim comes in.

For the past nine years central-station engineers have repeatedly pointed out to both equipment manufacturer and prospective buyer the various items giving actual comparison as to maintenance and repair costs on various types of plants, and calling attention to the fact that noise and offensive odor are both unnecessary, that sooner or later a community will so learn and by legislation or otherwise compel the installation of such equipment as will eliminate these objectionable features. In several cases the installation of gas and oil-driven prime movers has proven a most expensive equipment, some of them having been in service less than two years before being compelled to change to a less objectionable method of operation, electrically driven equipment being supplied in every case.

As to the third item, the fact has slowly but surely been driven home that dependence upon natural weather conditions for a full ice supply is too much

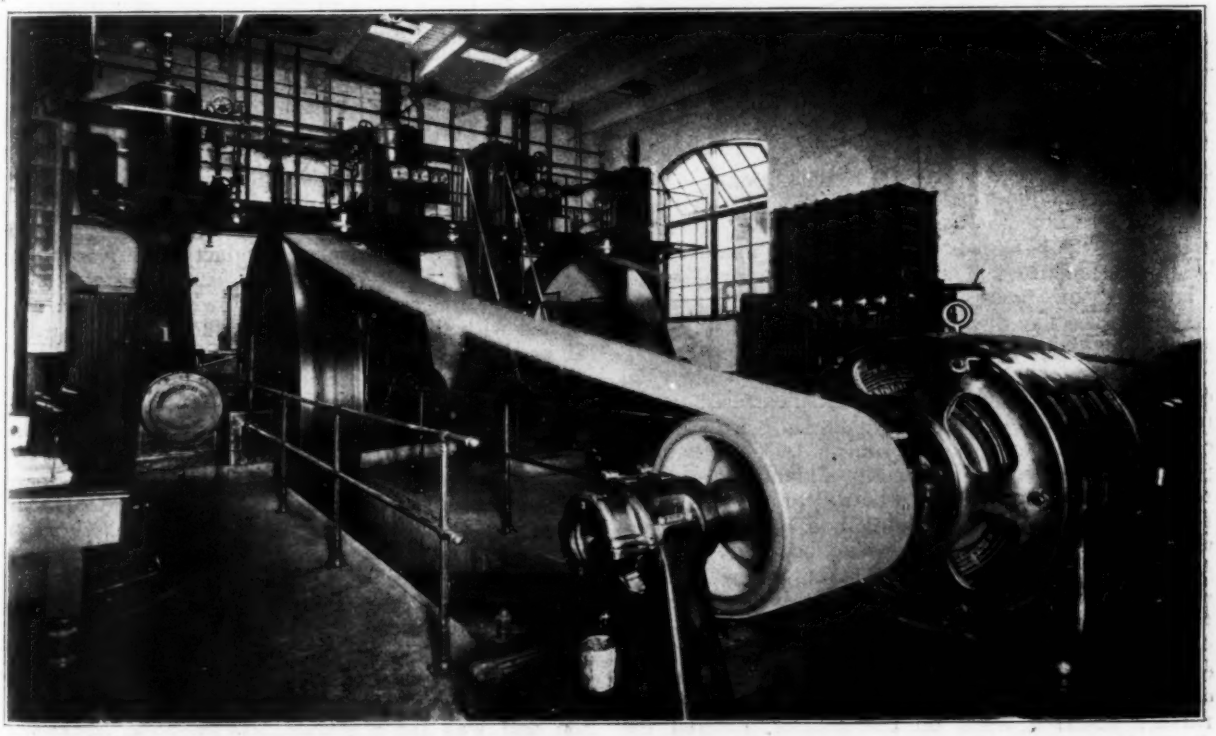


Fig. 1.—Ice Plant with Two Motor-Driven Compressor Sets—Control Board and Resistance Banks in Background.

of a gamble, as ice dealers throughout the entire country have learned by bitter experience and many of them have made or are making preparations for supplying their needs either in part or entirely with artificial ice. "I told you so" is a phrase central-station sales engineers, or in fact any other interest dealing with the general public, should avoid, yet in connection with this particular class of business it not only is a fact but a matter of record in referring to the item just mentioned.

Nine years ago a splendid quality of ice was first manufactured from raw or untreated water as distinguished from distilled water and this process made possible the use of central-station service in the operation of plant equipment, as a direct competitor with some other form of prime mover. Numerous tests and analyses were made and in every case the raw-water ice was proven superior to distilled-water ice, yet for a number of years the manufacturers of ice-making equipment would not concede its equality even and made every effort to retain the distilled-water plant as a standard.

Now after years of experience in the manufacture

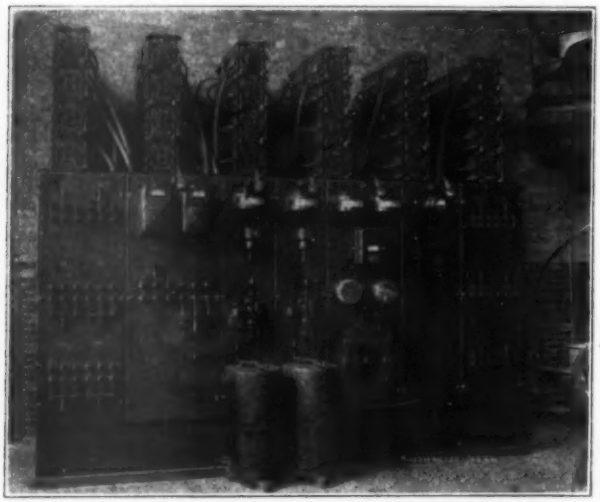


Fig. 2.—Control Board and Resistance Banks for Two Variable-Speed Motors in Ice-Making Service.

of raw-water ice, if we analyze the situation dispassionately, we wonder not only why raw-water ice was not made—commercially—years ago, but why distilled-water ice was ever made a standard of manufacture or the system used at all excepting in special cases. There are, of course, cases where the water supply is such that the distilled-water process is the only method possible, but such cases are rare.

How far reaching is the effect of precedent, when once it has gained impetus, is well illustrated in the manufactured-ice industry. What light we can get on the early history of the subject tells us that the projectors of the first artificial-ice plant encountered water of such characteristics that clear ice would not form, although such a crude method as paddle agitation was attempted in its production, and the only solution possible was to first make the water into steam and then condense it, using this distillate for freezing into ice blocks. As this method proved reasonably successful, other plants using the same general method of ice production followed, and from this one case of absolute necessity of process, without further research work on the subject, entered the distilled-water ice plant that has been the standard method for artificial ice manufacture in all parts of the world until up to a few years ago.

Now the weight of "precedent" is again having its effect, and the installation of a distilled-water ice plant is as rare as was that of a raw-water plant ten years ago.

Who of us, young or old, has not noticed that clear or crystal ice was always formed on a moving body of water and that pond or stagnant water always would freeze muddy or opaque? This object lesson of nature has been before us for ages, yet it was only nine years ago that this simple fact was demonstrated in a commercial way.

Ice in forming first freezes over the top, then works downward, the impurities and most of the insolubles being washed away by the movement of water in the lake, river or stream, the result being clear crystal ice. And from this simple fact has evolved the raw-water ice plant of today, the water in the cans being kept properly agitated by air pressure during the freezing process. As we advance in the art there are, of course, such improvements as filtering and treating the water in order to remove all the impurities possible before delivering it to the ice cans for freezing, but such processes tend to make cheaper and better ice. The main fact remains just the same, however, and that is the necessity for keeping the body of water in agitation during the freezing period in order to procure clear ice.

Some years ago the statement was made that the most economical plant from the viewpoint of investment, operation and distribution was the simple low-pressure, raw-water ice plant of from 80 to 100 tons daily capacity. Since then hundreds of plants of various capacities have been built, no two of them exactly alike, yet from the great mass of records collected the simple plant still stands preeminent. This statement is made of course having in mind all three items combined. There are plants of large production that can manufacture cheaper ice but lose when it comes to distribution of the product as against the average small community plant serving a city district or distinct community.

Such a statement as the above must be a general one as there is no possible way to make a direct comparison. The simple plant will and does make good commercial ice of such quality that it sells at the same price as ice made by some other process costing more on the power side and overhead expense but less in labor, and apparently a higher grade product as compared with the simple plant product when placed side by side.

We of the central station, however, are not concerned with the method of manufacture or the grade of product. Our concern is to maintain a satisfied customer and one whose records are open to us in case of need or desire.

It is a strange fact, however, that although nine years have elapsed since the first large raw-water ice plant electrically operated began operation and many various types have been installed, the average kilowatt-hours per ton has not changed materially. For example, the most economical raw-water ice plant of which it was possible to get records for 1915 showed an operation of 37.9 kw-hr. per ton, the plant being of 200-ton daily capacity, simple, low-pressure, drop-pipe system. The combined operation of the best 8 plants for the year was 44 kw-hr. per ton.

For 1918 the best operation was 38.5 kw-hr. per ton and was for a simple, low-pressure, drop-pipe plant of 100-ton daily capacity. The combined opera-

tion of the 12 best plants was for the year, 43.2 kw-hr. per ton. The above covers plants in the Chicago territory only.

Status and Growth of the Load in Chicago and New York.

To show the great growth of central-station-operated ice and refrigerating plants two large cities only will be taken.

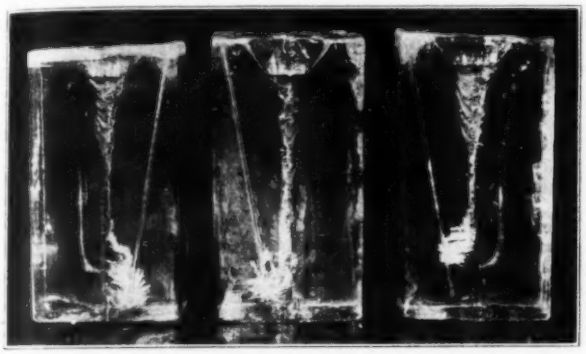


Fig. 3.—Raw-Water Ice Made by De La Vergne Process.

In the Chicago territory seven plants were added during the year 1918, six of them being steam plants making distilled-water ice and changing to raw-water ice with electrically operated equipment, and these combined with those already on central-station service made a total of 32 large ice plants.

These combined plants have a total connected load of 13,431 hp.; the combined maximum load in summer was 9589 kw. with a total consumption of 32,610,868 kw-hr. for the year. This total kilowatt-hours includes not only ice-making but about 1,600,000 gal. of ice cream and the operation of about 60 electric trucks of from 3 to 6 ton capacity delivering ice and ice cream.

In addition there are two large cold-storage plants having a connected load of 2100 hp., and consuming 3,935,640 kw-hr. for the year with a combined maximum of 1079 kw. and an additional large cold-storage plant with a total connected load of about 2400 hp. using this service indirectly, it being a large user of central-station service for various purposes, the cold-storage plant proper being but a part of the load.

For the year 1919 one of the Chicago plants, a combination cold-storage and ice-making plant, will discontinue ice-making, leaving 31 plants for ice-making.. Nine new and additional plants have contracted for service by June 1, making a total of 40 plants for Chicago at that time. In addition four plants are enlarging and the total connected load for ice-making arranged for so far this year will be 17,023 hp.; approximately 800,000 tons of ice will be produced, and 50,000,000 kw-hr. of energy consumed in the ice industry alone.

In addition there is now in course of construction just outside the Chicago territory the largest artificial ice plant in the world. It will be electrically operated, will have a connected load of about 2000 hp. and a capacity of from 600 to 700 tons of ice per day.

In New York there are 12 large ice and cold-storage plants already operated from central-station lines with eight more being changed to electric drive, making a total of 20 plants by 1920. With but one or two exceptions these have all been converted plants. Records have not been received in time to be included in this article as to kilowatt-hours and total connected load, but it is estimated the combined plants will require 50,000,000 kw-hr. for the year 1920. The above does not include plants in Brooklyn or surrounding suburban territory but New York proper only.

If we add to the above the numerous plants going in the smaller cities and towns from reports gathered in a general way there will be close to a hundred additional electrically operated plants connected to central-station service this season and that surely should be evidence enough to prove the desirability and popularity of such service.

Apropos of the statement on the maintenance item in the early part of this article three plant owners representing 11 plants and having plants that have been longest on central-station service were asked regarding repairs, etc., on prime movers and by that we mean large motors on compressors that replace steam-driven equipment. The reply of each was that in nine years' time the only expense had been brushes for collector rings. It is physically impossible for a steam, gas or oil engine to produce a like record even for one year, let alone nine.

Features of the Motor Drive.

One of the hardest things to "down" was the apparent necessity insisted upon by the engineers for speed regulation and machine operation for hours at a time on slow speed. The accompanying illustrations, Figs. 1 and 2, show such installations. Note the enormous banks of resistances necessary for the speed control demanded. Needless to say, most engineers now recognize the utter uselessness of such requirements, although occasionally some consulting engineer calls for the variable-speed feature but is now easily convinced of its uselessness. Variable speed on an ice or refrigerating machine when operated from central-station service is neither necessary nor desirable as by far the cheaper operation under such conditions is to run full capacity without motor resistance as long as necessary, and then shut down

Fig. 4.—Crane Handling Three 400-lb. Cakes of Ice—Newer Types Can Handle Six Cakes.

for a definite time, much as an automatic machine would do. If reasonable speed change is desired it can be obtained by changing pulleys. In that manner not only are best results obtained but cheaper rates and lowest cost in operation.

As with the necessity of distilled water in ice making where muddy water was encountered in the first artificial ice plant and then blindly following

that procedure in subsequent plants without any further investigation, so with the slip-ring motor in connection with compressor drive. As stated engineers wanted variable-speed features as they had always had them on steam equipment, and as slip-ring motors were the only alternating-current type possessing such characteristics, of course slip-ring motors were used, and in the large majority of cases we have continued to use them even after establishing the fact that variable-speed requirements were not necessary.

Recently, however, we have discarded that idea. Synchronous motors are just as adaptable and much

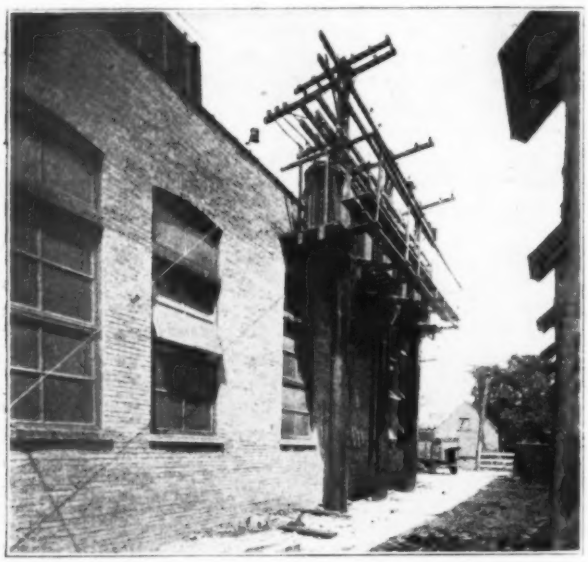


Fig. 5.—Typical Outdoor Transformer Bank Serving Ice Plant.

more desirable both from the central station's as well as the customer's viewpoint, as they have a slightly higher efficiency, and at unity power-factor will tend to correct the power-factor not only for the plant induction load in auxiliary motors but also as a line corrector to a limited extent in the immediate vicinity. There is no doubt but that the compressor motor of the future, and especially from 100 hp. and upwards, will be the synchronous motor.

In the nine new ice plants now under construction 12 synchronous motors will be installed on compressors and motor-generator sets. As to the starting torque of such motors only one such compressor motor has been tested so far by us—a 225-hp. 200-r.p.m., 220-volt Electric Machinery Co. motor direct-connected to a De La Vergne compressor. This motor, having a running current of 480 amperes, required 57 seconds to come from rest to full speed and required 720 amp. at pulling in. As the compressor has a 6-ton flywheel to overcome as well as machine starting this performance is most excellent.

The ice pictured in Fig. 3 is raw-water ice manufactured by the De La Vergne process in which the air pipe is hung from the side of the can at an angle such that the air outlet is at the center of the can and about 12 in. from the bottom. Dry air (dehydrated by the refrigeration process) is supplied through a header and hose connection, the pipe being frozen into the cake of ice. To release the pipe from the ice, a steam or hot water needle is inserted into the air pipe, releasing the pipe so it can easily be withdrawn. The pipe hole is readily seen in the picture.

Fig. 4 will serve to illustrate another improvement tending to reduce production cost—in this case labor. It shows a crane handling three 400-lb. cakes of ice. Imagine, if you will, this crane carrying six in place of three cans. One of our plants has just completed the installation of a six-can crane.

The tanks are 24 cans wide and the air laterals are arranged to supply air to six cans at a time. A water-softening and treating device was also installed. The cans are filled at the dump end of the tank and the cranes are equipped with motors for rack-lift and travel. The result is a novice can operate it; the necessity for manual labor being reduced to a minimum, labor will stay. In this plant, one of 200-ton daily capacity, the net result of the installation of crane and water softener is the expense of six men per 24 hours is saved. As these cranes are in operation but not sufficiently completed so that a good picture could be taken the three-can crane is shown as being best able to illustrate the point. Another advantage in this system is that with cans filled at the dump no hose is required for can filling to be hauled all over the deck.

Apart from the ice manufacture and larger refrigeration side of the question there are numerous other applications of refrigeration equipment that central stations should keep in mind and that are more or less special applications.

One such case is that of refrigeration for theater and moving-picture houses. We are now getting ready two such installations, each requiring a 100-hp. motor on a refrigerating machine supplying cold air to the theater; each of these houses has a seating capacity of about 2800 persons. Special meters will be installed in order to learn the cost of such refrigeration.

Methods of installing customer service, or "his power plant" as we call it, for this class of business may be of interest. For the average ice-manufacturing customer the transformer bank is usually installed on a pole platform and if possible so located as to make the shortest possible line drop from the secondary side to his service switch; this is shown in Fig. 5.

Many such customers, however, have very artistic buildings and do not want them disfigured with such equipment, to use their expression. In this case transformer vaults house the transformer as well as line equipments. Fig. 6 shows such a transformer room. The customer provides the room necessary for such an installation.

The question has been asked "How about central-station competition?" As a competitor the distilled-water plant system is in no way to be feared. It will still have its place but from necessity not economy. The best of such plants, taking the average operation over a life of several years, and that only when operated and watched by careful supervision, will produce an average not to exceed 6 tons of ice per ton of coal of say 11,000 B.t.u. heat value.

At present prices of coal the cost for fuel alone will range from 50 to 200% more than the average cost of electrical energy in a fair or large sized plant. Such a statement can be only general as rates vary in different localities but the saving in an electrically operated plant is very evident when properly analyzed.

The most economical types of plants as direct competitors to the central station are the plate ice plants and the can plants having uniflow or poppet valve engines with superheated steam and operating condensing. When, however, we can get the prospective buyer to lay all his cards on the table and con-

scientiously consider every item of investment, operation, location, maintenance and repairs, to place one type of plant fairly against another the electrically operated plant will invariably be the selection.

There are also numerous applications for small machine installations in restaurants, florist shops, groceries, markets, etc., and a tremendous number of them are being installed. It is not the intention to go into the subject of small refrigerating machines for such as well as household work at this time; more full data on this will be presented in a later article. The small electrically operated machine, however, is finding its way more and more into such places.

The household machines likewise are on the way and their name is legion. Something over forty of such machines have been investigated from time to time, but the staying qualities of many of them seem to be very weak. Hardly a week passes but we hear of some new design or principle but that apparently is as far as many of them go.

In general such machines are of two types, rotary and reciprocating and these again being divided into

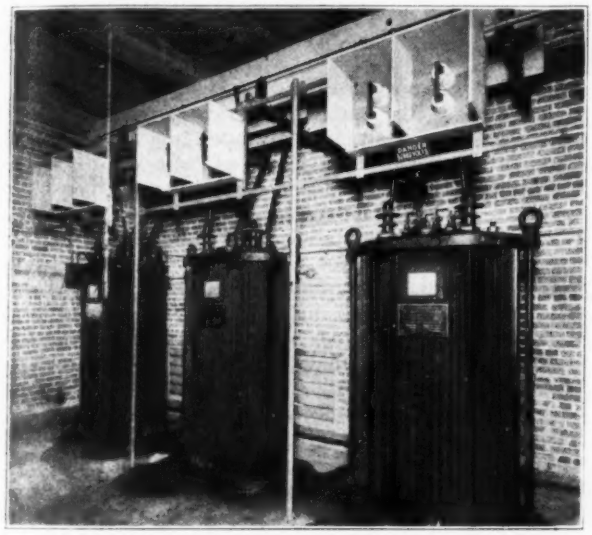


Fig. 6.—12,000-Volt Transformer Vault in Ice Plant.

water-cooled and air-cooled—as to system of operation.

Just a word as to new processes in ice manufacture. A new invention has recently been brought out although not yet thoroughly proven in. It consists of first treating water so as to throw down as much of its solid matter as possible and then treating it chemically as the water is delivered to cans, the object being to agitate the water by chemical rather than by mechanical means during the process of freezing.

It is claimed that such a system would lend itself most excellently in changing over a distilled-water plant to the raw-water system. Although successful in test operation in a small way this system has not yet proven itself commercially.

In conclusion, there is but this to say. The pioneering work connected with central-station service for artificial ice manufacture has been completed and has "proven in." There are enough such plants of every description connected or being connected to central-station lines to give the investigator almost any information he might desire. With such information and records for service as we have back of us there can be but one answer—central-station service of 100% for ice and refrigeration operation.

ADVANTAGES OF ELECTRIFICATION EXPLAINED TO CANADIAN ENGINEERS.

F. H. Shepard of Westinghouse Electric & Manufacturing Co. Delivers Interesting Address.

At the recent annual meeting of the Engineering Institute of Canada, F. H. Shepard, director of the heavy traction department of the Westinghouse Electric & Manufacturing Co., presented a very able paper on the electrification of railroads. In his address, Mr. Shepard brought out very clearly the growing need for electrification in this country and its many advantages as well as the remarkable results which have been obtained in its application.

Due to the vast area of this country, its growth and prosperity have depended largely upon transportation facilities, and for this reason any improvement in the railroad condition is especially important. That the substitution of electric for steam power will improve these conditions has been amply demonstrated in every instance where it has been applied. The only explanation, therefore, why railroad electrification is so limited may be ascribed to that inertia which halts the undertaking of large works, accompanied, as they inevitably are, by such complications as questions of finance, immediate necessity, immediate return, etc.

An advantage of railroad electrification rests largely in the ease with which large amounts of power can be used for a single train, and in the facility with which electric power can be applied, regulated and controlled. These advantages secure fewer and accelerated movements of train units and larger trains as well. Increased capacity and service, therefore, directly obtains from existing tracks, terminals and equipment.

The ability for service of electrical equipment as compared with steam is truly amazing. The length of time out of service necessary to insure reliable operation is very small—a common schedule for inspection of eletcrical equipment is at the end of 3000 miles operation, while a much greater mileage is frequent and there are individual records as high as 10,000 to 12,000 miles. The maintenance is therefore considerably less for an electric locomotive than for steam and this saving, which is generally taken to be about 50% will probably be materially increased in future installations.

The ever present necessity for increased efficiency in transportation has already brought about a very material increase in size of trains. With steam power this has been secured at great increase in size of locomotives, revision of line, reconstruction of bridges, etc. Undoubtedly, had electrification been available, much of this capital expenditure would have been obviated, owing to the flexibility with which electric power can be applied.

The saving of fuel due to the use of electric power is, of course, complete in the case of hydro-electric supply and is 50% or more from steam electric generating stations. This considerable saving is due both to the great efficiency of steam generation in large units under the economical arrangements obtaining in modern power-houses and to the avoidance of losses at the locomotive itself.

In these days of increased costs, that for the supply of electric power is almost alone in having been stationary or even reduced during recent years. This has been due to the economies obtained by the generation and distribution of large amounts of power. The present, therefore, seems to be a particularly opportune time for actively undertaking the extension of railway electrification.

Commercial Policies of Central-Stations

War-time Policies and their Lessons in Meter Reading, Billing, Making Trouble Calls, Lamp Renewals and Similar Practices Concerned with the Commercial Work of Utilities

COMMERCIAL policies and practices of the central station are understood to be those practices and policies that have to do with the commercial public-policy and financial sides of public utility operation as differentiated from the technical. Roughly, these commercial policies embrace such matters as the methods of metering and billing customers, of obtaining and encouraging load, merchandising and general building up of that bond that is so important for the best interests of both customer and company.

Service, in which the central stations—in fact, all public utilities—have taken so much pride, and which has been developed to such a high degree of art, was restricted, curtailed and in some instances eliminated altogether when the war came with its necessary retrenchments. What had been liberally given away gratis suddenly assumed the aspect of an extravagance. It was frowned upon under all circumstances and could be obtained at best only in a modified way for a charge. The aim was not to make profit out of service but to restrict that service and discourage expectancy and the demand for it.

Out of this state of things must come reaction, as always. As conditions approach normal, retrenchments will give way to extensions, economies to expenditures, until the high quality of service comes again. Meanwhile, many of the policies and practices in vogue before the war that were allowed to lapse during the war and the readjustment period following it, will come again in a modified way. On the other hand, many of the war-time measures will remain, likewise modified, because of the benefits they possess. Every utility has its problems, the details of which may be pertinent to itself. But all have problems common to all other utilities. These problems deal with obtaining customers, serving them, charging them for service rendered and so forth. Some of the interesting policies that came about because of the war, and policies that have grown from them will be mentioned.

Meter Reading and Billing.

The cost of reading meters and billing the residence customer is a large item of expense, in fact the chief expense connected with the residence customer. The urgent necessity for economizing and lowering the cost of doing business coupled with the inability to maintain the force of men for reading meters, and doing the clerical work involved resulted in many companies adopting new policies and practices. Many companies adhered to their practices, although considering many suggestions that aimed to reduce the labor shortage and lower the cost of doing business.

The Philadelphia Edison Co., effective the first of this year, adopted the policy of reading meters and billing residence customers every three months instead of monthly. The Detroit Edison Co. employs a two-month period. It is understood these practices are permanent, as they have so far proved very satisfactory.

Attempts have been made in a number of communities to bring about a co-operative or unified meter reading and billing bureau. For example, in Kansas effort has been made to have electric and gas meters read and billed by the men, although different companies operate these utilities. Some utilities, operating both gas and electric, had been in the custom of billing each separately on separate bills, but have now combined the two on one bill. The Public Service Company of Northern Illinois is one of these companies.

One of the most prolific sources of lost time is due to inability of the meter reader to enter residences when the tenant is absent; continued inability to obtain readings involves not only loss of time but the question of whether the reader is doing his work conscientiously. One way of overcoming this difficulty, recently adopted by the Public Service Company of Northern Illinois, is to deliver a blank bill across which is stamped "Your bill cannot be rendered because our meter reader found no one at home when he called." This statement explains why a bill does not arrive, and tells why, a month later, the bill appears higher than usual. Moreover, the responsibility is placed upon the customer while the meter reader's calls are checked. Another practice that takes care of the meter unread because access could not be obtained due to an absent tenant is to send, or leave at the time of attempting to read the meter, a return stamped postal card, which states the reader could not read the meter and asking that the relative positions of the pointers of the meter dials be indicated upon dials shown on the card. How to read the meter is explained.

The Houston Light & Power Co. uses a duplicate form of bill in which the duplicate folds over, the customer receives the carbon copy, the original being retained by the company. This reduces the amount of handling and trouble and delay should the customer lose his bill or come to the office without it. The company finds that 90% of the customers who apply for duplicate bills either have lost their copy or failed to take them along when going to the office to pay them. Frequently the customer knows the amount of his bill and only wants a receipt, while the company also requires a record that the account has been settled. It might be pointed out that this type of bill is most applicable when bills are paid only at one office, hence is not useful where drug stores, branch offices, etc., are used as pay stations.

A number of companies have taken to sending out notices with their bills during the early winter months, explaining why the bills for the coming months will probably be higher than those of the months past. That the daylight-saving law is out of season, that the actual hours of daylight are fewer, that the days are becoming colder and many of them

darker are given as reasons why the electric light and gas bills will be higher.

Labor is conserved by making available labor do more or reducing the work to be done. The labor shortage during the war, and its cost were met so far as meter reading and billing are concerned by reducing the work to be done and using labor differently. One of the practices most largely employed was that of replacing men by women and schoolboys, the former for meter reading, the latter for bill delivering. Many companies are adhering to the use of women meter readers, replacing them by men, however, as the women resign and leave the company. The state of Pennsylvania has prohibited the use of women for certain work, and this acted as a deterrent to many companies who might have employed women on a larger scale than they actually did.

One time-saving measure adopted is to combine meter reading and billing, leaving the meter reading at the time the meter was read, or using the same force for delivery purposes when they were not reading meters. While this is still being done by some companies, others have found it quicker and cheaper to have the meter readers adhere to the reading and the deliverers to delivering. One of these is the Dayton Power & Light Co.

In many cases companies are considering, and some have already adopted, mechanical bookkeeping, and billing, which naturally follows. Whereas mechanical bookkeeping was once considered primarily as a method of dispensing with man power, it is now judged upon the unit cost of doing the work.

Free and Charge Trouble Calls.

Companies that had taken a pride in answering trouble calls with the speed that a fire department answers a fire alarm had to retrench and operate with a smaller force. As eliminating the dispensable free service was preferable to increasing rates, free trouble calls and fuse renewals and similar work was eliminated everywhere. Instead, most companies instituted a nominal charge for renewing fuses, clearing up a ground or crossed wire and similar trouble the fault of the customer such as occurs daily in many domestic and industrial installations. The charge, usually 25 and 35c, was enough to cover the actual material expense and at the same time act as a deterrent to the unreasonable and thoughtless customer, but not deter the one really in trouble, nor encourage unwise alternative methods.

Making a nominal charge for fuse renewals and trouble calls does not entail the difficulties that does that of repairs for appliances and appliance cords. This latter is a more difficult matter as to what to charge for a number of reasons. A current-consuming device that is not working because defective is of little value as a load builder. Moreover a defective device only serves to irritate the owner. In charging for appliance repairs and cord renewals, great care must be taken not to discourage the use of these devices on the one hand by making excessive charges, nor yet giving a service gratis where a charge sufficient to cover the cost of materials and labor can be justly and equitably charged, since the expenses must be ultimately met. This has been accomplished by different companies in different ways. Rates must be low, and this is accomplished when the charge merely covers the expense of materials involved. That introducing a charge for making repairs to current-consuming devices does not prevent needed repairs from being made—while it doubtless does discourage needless repairs—is the opinion of some of the companies that have adopted the above practice.

Some central stations have ceased doing any unnecessary repair work upon customers' premises, such as motor repairs, etc., and instead hand this work over to local contractors. In some cases the utility is the go-between, in other cases the customer is referred to the contractor directly. By adopting this latter policy the Dayton Power & Light Co. has been able to greatly reduce its cost of free repairs without affecting the revenue derived, while local contractors have benefited.

Lamp Renewal Policies:

Whether lamp renewals shall be made free of charge has long been a mooted question, because it is one that embraces such matters as the amount of revenue obtained from lighting, the amount of light obtained per kilowatt-hour, and the extent to which the doctrine of efficiency and high intensities is followed. High cost of lamps made many companies take to making a charge that covered their expense. Whereas lamp renewals has been made free of charge by some of the large companies, like the Commonwealth Edison Co. of Chicago, and delivered free of charge upon a few hours notice by telephone, a policy of charging for renewals delivered has been adopted. Renewals are free, but if delivered a charge is made for deliveries, 35 cents per call regardless of number of lamps delivered. This serves to deter the customer wanting a few lamps from asking that they be delivered, but does not interfere with those that want a large number, as for a theater, etc. The delivery charge merely acts as a deterrent for those that expect a needless luxury and unnecessary service.

During the last two years more than one hundred of the large central station companies have changed their lamp-renewal policies. Some of those that still adhere to the free renewal doctrine have under advisement the matter of adopting lamp exchanges on a list price basis. In many cities the central station is adhering to lamp sales on a list price basis in which the local contractors and dealers are co-operating.

Co-operative Purchase of Merchandise.

Co-operative purchase of electrical merchandise by a number of central-station companies, a practice adopted more than a year ago, has proved so successful that the practice is being continued. One of the conspicuous instances where merchandise is being purchased upon the co-operative principle is that of the Commonwealth Edison, Henry L. Doherty, Narragansett Electric Lighting, Edison Electric Illuminating, Union Electric Light & Power, Philadelphia Electric, Potomac Electric Light & Power, Consolidated Gas, Electric Light & Power, Public Service Co. of New Jersey and the Edison Electric Illuminating Co. of Brooklyn. These companies purchase certain types of electric merchandise, notably lamps upon a co-operative basis. By pooling their orders and times of delivery they are able to buy at a price about 50% with better deliveries than obtainable were each purchasing independently in the open market. Overhead, investment in stocks, as well as the actual price is lowered.

Line Extensions and Wiring Campaigns.

Line extensions were frowned upon by the Government early in the war. Difficulties in obtaining men and materials and of financing them also combined to stop all except the most urgent extension of

lines. Plants that were to engage in munitions work were called upon to pay for the cost of connecting up central-station service. Most of these contracts required the customer to find the capital for making the extension, it being agreed that the utility would refund the cost in yearly payments plus interest. Though the war is over, many of the large central stations still adhere to similar arrangements as the above.

Somewhat allied to line extensions is that of wiring existing houses. House-wiring campaigns almost entirely ceased during the war. Lately, however, the utility companies have gone out after this class of business in all seriousness. Some of the central stations do the wiring themselves, some sublet the contracts to local contractors, and some carry on an advertising campaign in co-operation with dealers and contractors. In nearly all instances, payment on the installment plan is optional.

Publicity and Merchandising Methods.

The war wrought havoc with the selling methods of all industries, and in central-station merchandising new methods have very largely replaced the older customs. With sales forces depleted, the utilities had to adopt other tactics of reaching their prospective customers and keeping up their sales. Without choice in the matter they took up upon a larger scale than previously the only alternative left them. These consisted chiefly of publicity and propaganda through advertising in local newspapers and magazines, through the mails, on bill boards and similar ways; and through making every employe a salesman of current-consuming devices, giving commissions in cash or merchandise and publicity to their achievements to act as incentives.

One of the outstanding features of the last year or so is perhaps the extent to which all public utilities have taken to publicity through the many mediums such as newspapers. This was due at first to the appeals to the public when coal shortages occurred, when service was suspended on fuellness days and when artificial lighting was curtailed. New rate increases were forecasted by telling through the newspapers of the hardships encountered, the importance of public utilities to national endeavor, what the President had said about standing by the utilities and so forth. With the good results that followed this method of prompting the public and appealing to them, naturally, when the time came to increase merchandising in face of curtailed sales forces, the newspapers and similar medium were resorted to. The consensus of opinion among the companies that have taken to newspaper advertising, hence that have gained most from it, therefore, seems to be that hereafter these channels will be continued to be used even though the sales force reverts to its pre-war basis. The former will be used to pave the way for the latter.

BOOK REVIEWS.

"Public Utility Rate Fixing." By C. E. Grunsky. San Francisco: Technical Publishing Co. Cloth, 170 pages (5½ by 8½ in.). Supplied by International Trade Press, Inc., $2.50.

No sooner does a court specify what elements must be considered in establishing rates, then the reasonableness and equity of the court's ruling begins to be questioned. The rule set forth by the Supreme Court in the case of Smyth vs. Ames to the effect that: "The basis of all calculations as to the reasonableness of rates to be charged by a corporation maintaining a public highway under legislative sanction must be the fair value of the property being used by it for the convenience of the public," has been generally followed by rate-fixing commissions and authorities.

The author in the series of articles collected and bound in one volume endeavors to make it plain that value is not the logical starting point for fixing public utility rates. He points out that value is a result and not a cause. Furthermore, he reasons that it is not the court's function to determine a proper basis for rates but merely to see that the rates do not result in confiscation nor create excessively high values upon which rates are based.

Commissions that have wrestled with the problem of a proper rate base will find much illuminating discussion in the book. Stated in a sentence, the author's proposition is that "the rate base which is in every respect satisfactory is the legitimate, properly determined investment, undiminished by depreciation, but with due consideration to the cost of developing business." This proposition he substantiates by chapters on General Comments on Rate Fixing; Elements Deserving Special Consideration When Rates Are to Be Fixed; Appraisal of Real Estate Adapted to Special Use; Determination of the Value of Real Estate in Eminent Domain Proceedings; Depreciation and Appreciation; the Value of Water Right; the Rate of Return; the Rate Schedule; the Public Utility Rate Base; Fair Value and the Rate Base.

C. M. Jansky.

"Essentials of Alternating Currents." By W. H. Timbie and H. H. Higbie. New York: John Wiley & Sons. Cloth, 374 pages (5 by 7 in.), 223 illustrations. Supplied by International Trades Press, Inc., for $1.60.

This is a good elementary book by Professors Timbie and Higbie. The former is professor of applied science at Wentworth Institute, Boston, who has served as editor-in-chief of the War Department's Committee on Education, Special Training and Vocational Instruction; the latter is professor of electrical engineering of the University of Michigan. The book is prepared admirably for the use particularly of elementary students and workmen who are preparing to handle alternating-current machinery. It can be read profitably by engineers other than those who have specialized in electricity. It demonstrates very clearly that the fundamentals of alternating current can be presented in concise and readily understandable form so that the self-taught man can comprehend them.

A feature of the book is the fact that the subject is presented without recourse to analytical mathematics. Many numerical problems are solved, but the solutions are all effected graphically by means of vectors and triangles. The use of vectors in elementary texts is to be commended, since it supplies the student with a visual conception of his problem that mathematical equations do not give. Each of the ten chapters is followed by a summary of the material in the chapter and by a long list of exercises and problems for solution. The only criticism that can be made about the problems is that answers are not included in the text. The advisability of including answers in a text is a mooted question, however.

The theory of alternating currents is made clear by a large number of vector and wiring diagrams. The practical control of alternating-current circuits is illustrated by a correspondingly large number of halftone views of machinery of the latest models. This book should prove very useful to all who are seeking a brief and easily comprehended treatise on the essentials of alternating currents.

The Field for Industrial Electric Trucks and Tractors

Tremendous Possibilities of This Equipment But Little Known—Some Features of the Apparatus—Need for Central-Station Co-operation

THIS is the first of a series of articles dealing with the application of industrial electric trucks and tractors. In this the subject is treated in a somewhat general manner. An idea of the tremendous possibilities in this field is given and also some information on the details of the equipment and what it will do. In the following articles the application of trucks and tractors to 12 specific industries will be discussed in a comprehensive manner. The possibilities for their use under varying conditions will be shown, as well as facts and figures on actual installations.

INDUSTRIAL transportation by means of trucks or tractors using electricity as a motive power, although it has had a very substantial growth since its introduction a few years ago, has been greatly eclipsed by many other electrical applications during this period. This lack of growth can be chiefly attributed to two reasons which may be briefly stated as follows.

In the first place the value of this method of hauling is not as readily appreciated by manufacturers as many other applications. The labor it replaces or whose working power it increases was, until the outbreak of the war and the resultant scarcity of labor, comparatively cheap and abundant and the original investment relatively high. Furthermore in some cases the character of the saving which the installation of electric industrial transportation equipment makes possible is rather vague. It cannot be prescribed to any single operation entering into the finished product in such plants but is accomplished by numerous savings in different departments or by a reduction in the operating or overhead expenses of these departments. It follows, therefore, that these savings cannot be predetermined unless an adequate accounting and cost system is kept in these plants.

Secondly, either through neglect by the manufacturers of traction apparatus or by disinterestedness on the part of the central stations and other electrical interests, sufficient co-operation and stimulus has not been given to the introduction of the equipment used in this work, or to the possibilities.

In common with all other labor-saving apparatus the war gave the application of electric industrial trucks and tractors a powerful impetus. The extreme labor conditions created during this time, when manpower became its most valuable asset, forced upon industry the immediate adoption of any device which would enable production to continue. There was no longer any opportunity to balance the investment necessary to install automatic equipment against its saving over the old manpower methods for the latter could not be maintained. The question became one of delivery and performance and here the electric industrial truck and tractor proved their worth. Many manufacturers that had previously been unapproachable ordered, and repeated their orders, for this equipment and found substantial proof of the claims that had been made.

Will the impetus thus given be lost or will the electrical industry as a whole grasp the opportunity it

Typical Scene Showing Tractor Hauling Long Train of Trailers in Railroad Station.

Unloading Freight Cars With Electric Tractor, Showing Flexibility Obtainable.

offers to add another principal use for electric power? To the central-station it offers great possibilities for a large load of a highly desirable character. To the contractor-dealer it offers additional profits in the way of increased sales and the installation of charging equipment, etc. To the industry as a whole it offers another application for electricity with exceptional accessory possibilities and further prominence for electrical apparatus.

In this article, which is the first of a series dealing with electric industrial trucks and tractors, the more prominent mechanical and electrical features of the apparatus and some of the more recent improvements in design and equipment are described. The possible field for their use is also covered in a general introductory way and the advantages which they offer to industrial plants and the different electrical interests explained. Each of the succeeding articles will describe the practical application of this apparatus in some prominent industry with the intention of demonstrating to similar industries the advantages and savings which their use makes possible.

The subject of industrial electric traction immediately calls to mind the small, silent, rapid locomotives, trucks or cars, hauling or carrying loads all out of proportion to their size, that may have been seen wending their way among the piles of luggage and crowds of people in large railroad terminals or among the material on shipping or receiving platforms. This is but natural, since the first practical application of tractors was for these purposes, and there is no doubt but that they still offer a great field for development. The vision must not be allowed to rest here, however, for this represents but a small portion of the possible field—a field so broad that it may be safely said to include nearly all lines of industry.

This statement may appear exaggerated to many, and so it would be, if the ability of electric tractors and trucks to effect savings in industrial transportation by replacing hand-trucking was the only use to be considered or to which they can be applied. Since the introduction of industrial electric traction vehicles this phase of their application has never been questioned and is generally understood. While it is not the intention to detract from the advantages possible in this work, an opportunity as great or greater exists in their application as a method in increasing factory efficiency and in performing a multitude of duties which could not be done by and are not associated with hand-trucking. In order to clearly understand the extent of these uses as well as to realize fully the savings which are made possible by the use of electric traction equipment, the many different kinds of apparatus and attachments and their advantages must be realized.

Various Forms of Apparatus and Auxiliary Equipment.

Industrial electric traction equipment may be roughly divided into two classes—locomotives or tractors, which are equipped with the necessary power and control apparatus and a place for the operator, but on which no provision is made for carrying; and trucks, which carry the same apparatus but on which space is allowed for the transporting of material, etc. These may be designed to run on tracks, where the route of travel is definitely laid out and where conditions are such as to restrict passageways very closely and the utmost power is desired, or they may be built with flat wheels equipped with tires for operation over almost any surface. The power, when it is desired to operate the machines on tracks, may either be received from storage batteries on the tractor or through some form of trolley from an outside source. Unless track operation is intended the power is received from storage batteries.

Where the apparatus is designed for use on tracks the limitations as to speed, size and power are unrestricted, which is especially true where the power is received from an outside source. The high cost of these equipments and their distributing limitations, however, prohibits their use except in comparatively few cases where these features are essential.

The storage-battery vehicle, on the other hand, designed for use on any surface has a far greater field and, although somewhat restricted as to practical speed and power, embodies these features to a sufficient extent for ordinary purposes. Although the fields of these two forms are sufficiently well defined and limited to prevent encroachment, the same auxiliary devices may be supplied with either and the methods which they employ are common.

The progress made in the design of these storage-battery trucks and tractors since their introduction has been very rapid. Many improvements designed to meet almost every industrial requirement have been made, either in the locomotives and trucks or by the addition of certain auxiliary features. Among the prominent improvements in the machines are those of

Typical Tractor Scene in Large Industrial Plant.

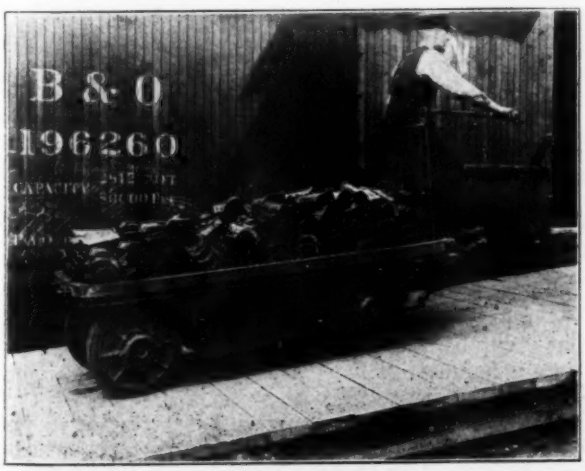
steering, braking, battery and motor features, controller and control equipment, diminishing the necessary turning radius, couplings and numerous safety appliances. Of the auxiliary devices, the automatic lifting, loading, dumping and crane attachments are most familiar, although tractors and trucks have been equipped with pumps, lifting magnets, conveyors, etc., to meet special requirements.

Mechanical Features of Storage-Battery Tractors.

The standard storage-battery trucks have a carrying capacity up to two tons and the larger tractors have a draw-bar pull of 1500 lbs. Extreme ruggedness has been incorporated into the design of both and they will permit of severe overloads and rough handling without any detrimental effects. Proper bearings, axles, springs and other mechanical parts are also of vital importance and should be determined before deciding on any certain make.

The width of the apparatus has been practically standardized at 37 to 40 in., this having been accepted as the greatest width which will permit operation in ordinary passageways. The length of trucks for ordinary commercial purposes seldom exceeds 10 ft., as it has been found that longer trucks are not practical and additional length is best obtained by the use of trailers. The length of locomotives varies according to the different uses for which they are intended but in general they are considerably shorter than the trucks.

The steering apparatus is very simple and substantial. Special pains are taken in the design of this apparatus in order that the action will be positive and the response to the steering control prompt. This is particularly desirable when they are to be used in narrow passageways. In order to permit the use of the vehicles in narrow passages and to reduce the turning radius to a minimum, manufacturers have adopted a variety of methods of steering and control. Nearly all machines can be driven either forward or backward which allows them to be driven into a small space loaded and driven out without trouble. To reduce the turning radius, some tractors are equipped for 4-wheel steering, in others one wheel is used in front The majority of the machines now on the market may be turned completely around in a space but a few feet greater than the length of the tractor itself.



View of Electric Truck Hauling Heavy Load Up Grade. Showing Possibilities in Loading Freight Cars.

An Idea of the Amount of Labor Saved by Using Tractors Is Shown by Their Application in Tube Plant.

In common with most other electrical apparatus these tractors and trucks may be started instantly and require but a few seconds to attain their maximum speed. They are also equipped with brakes which will stop the machine when fully loaded and running at top speed, within its own length.

Electrical Equipment on Industrial Tractors.

The electrical equipment of a simple tractor or truck consists of a storage battery, motor, and suitable control apparatus. To these have been added from time to time numerous safety devices. The methods of installing, of course, differ widely in the various types made by the different manufacturers and for the uses for which they are intended. They are usually provided with a substantial covering which affords protection but arranged so that easy access may be had to all parts when required.

The batteries may be either the Edison iron-nickel type or the lead type. The former being more rugged are recommended for use where the routes are rough or conditions severe. The latter, although weighing slightly more, are somewhat more efficient electrically. The batteries as furnished will supply the motor with enough power to run about 25 miles at an average speed of 6 to 8 miles per hour empty, which decreases slightly when loaded. Overloads such as are frequently encountered in climbing grades may be carried without difficulty, grades as high as 20% being common practice.

Batteries are usually charged at night or during slack periods. Where more than one charge a day is required it is commonly done by changing the battery, which can easily be accomplished in five minutes. The charging apparatus is the same as that generally used for charging the batteries of electric vehicles and trucks for street use. As no special engineering skill is needed in this operation and as it does not require constant attendance, the operator may be easily taught to make the proper charging connections before leaving, these can be disconnected by the watchman or some other employe when the charge has been completed.

The motors are the direct-current series-wound type, the size, speed and voltage depending upon the size of the tractor and the design of the battery. They are suspended underneath the body of the machine as close as possible to the driving wheels to simplify the transmission and to reduce the attendant losses. The transmision follows the general design of auto-

mobile transmission although many distinct features are often employed.

The control is usually of the drum type providing for three speeds forward and three reverse. It is inclosed in a cabinet and operated by a handle conveniently located.

In nearly all makes the steering apparatus and power control are operated by hand, while the brakes are controlled by a pedal. Safety devices which automatically disconnect the motor from the battery and set the brakes when the operator leaves the machine are provided on many makes in addition to a disconnecting switch or fuse which can be locked to prevent tampering or use by unauthorized persons.

Improvements in Auxiliary Devices.

To meet the various demands of different manufacturers a number of machines having auxiliary attachments to meet these demands have been introduced. The value of these attachments cannot be too strongly brought out for their proper application will often provide the necessary saving or efficiency feature. Briefly it may be stated that through the use of these attachments there is at present no form of hand-trucking which cannot be duplicated to advantage by the use of an electric power tractor or truck.

Perhaps the principal auxiliary feature so far developed and the one which presents the greatest advantages, is the lifting truck. The body of this truck is built so that it can be raised or lowered, using the power of the truck. In the lowest position, the body of the truck is about 6 in. from the surface level. This permits it to be run under skids on which the material to be moved has been placed. The body of the truck is then raised and the material still on the skid is carried to the next place. It has been estimated that the average time required to load and unload a truck is four times as great as the time required to actually move the material. It is evident therefore, that such trucks may be used to advantage even on the shorter hauls, formerly considered beyond the sphere of the tractor.

Another prominent feature which greatly extends the field of the tractor is the crane attachment. This attachment is simple, consisting of a gantry crane to be mounted on the tractor frame, the hook of which is raised or lowered either by a separate motor or by the tractor motor. With this device, tractors may be used in moving heavy machinery or materials. This is especially desirable in small plants where a traveling crane cannot be installed.

Good Operators Desirable.

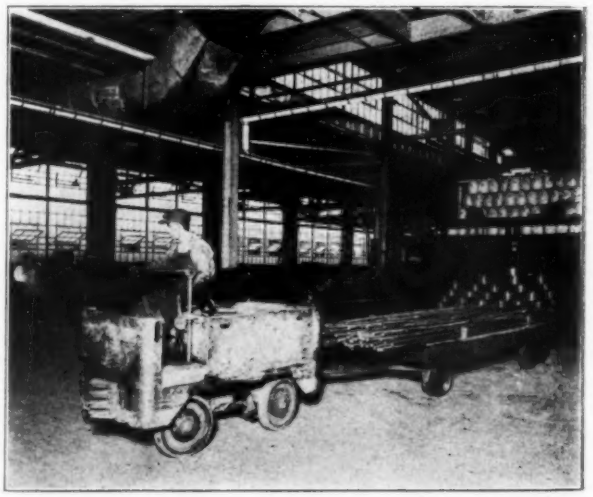
The selection of careful and reliable operators is a matter which very often is not given sufficient consideration. Many manufacturers and salesmen, desiring to lay too much stress on the simplicity of their particular make of apparatus have led purchasers to believe that the machine can be operated by anyone with success. The result has been that the machines have been left around the plant to be operated by anyone or, where special operators were assigned to them, care has not been exercised in choosing the men. This, of course, materially reduces the life of the truck or tractor and increases the upkeep cost and in many cases has made their use an added expense instead of a saving.

Although the control of the machines is so simple that a workman of average intelligence may be taught to operate one in about an hour, the proper results cannot be obtained except by the selection of good operators. Such operators being more highly skilled than the ordinary trucker command higher wages but it has been proven in innumerable cases that the savings effected more than repay the added expense of a good operator.

At this time it might be well to dispel one impression that seems prevalent among manufacturers and one which tractor salesmen may expect to come into contact with during the coming year especially. This impression is, that the returning soldiers, made strong and healthy by their military service will offer an abundant supply of truckers and similar labor that cannot be economically or patriotically ignored. While it is true that the vast majority of returning soldiers will be better equipped physically than they were before entering the service, it is also true that they will be much better qualified for work requiring trained and skilled workmen and will consequently expect such work. Furthermore, electric vehicles will permit the profitable employment of men who have been injured in service, and after all these men deserve primary consideration.

Field of the Electric Industrial Trucking.

It is generally admitted that where any considerable quantity of material is to be carried over distances in excess of 100 yd. electric tractors and trucks offer great economic advantages over any other method of handling. This limitation in distance applies to ordinary quantities of materials of such size that they can be easily handled by man-power. This, it would seem, restricts their use to the older factories where modern ideas of efficiency were not known at the time of building and prohibits their operation in the modern plants where progressive assembly and other similar efficiency methods are practiced. As a matter of fact, however, the opposite conditions prevail and the majority of practical economic installations are to be found in the progressive modern plants. There is no question but that this condition is brought about by the improved cost systems in use in these plants from which the approximate savings can be predetermined and the manufacturing policies which require that all equipment must be operated at its maximum efficiency. This condition does not lessen the



Electric Tractor Hauling Heavily Loaded Trailer in Industrial Plant.

opportunities for electric industrial transportation apparatus in the older plants but offers a profitable example which these plants may follow.

The problem of keeping highly paid workmen and costly machinery busy by keeping them instantly supplied with the necessary material and stock is a serious one and one which these machines can greatly help in solving. In many plants the adoption of the apparatus may not appear practical on account of the small amount of trucking that is done in them but their application in this respect warrants their purchase. A study of the operating conditions in such cases will very often reveal a practical field for the use of a power truck or tractor and a very substantial saving for the manufacturer. For example, in many large plants the materials and parts are kept in stockrooms from which they are drawn as required by the workmen. This practice involves a considerable loss of time as the workmen frequently have to wait their turn at the stockroom and often waste time in going a considerable distance for stock or returning. This waste of time can be largely eliminated by using tractors or trucks to deliver the stock, the orders for which are either telephoned to the stockmen or given to the operator on regular routes.

Similar savings can be affected in plants where material is taken directly from one department to another. Very often an appreciable increase in the savings can be made by using a lift-truck to haul receptacles which are mounted on skids. It can be readily seen that this method reduces the time lost in changing from one box or receptacle to another and the possible loss in breakage to a minimum.

The general utility features of these machines cannot be neglected for these are often the determining factors in their selection for use in small plants. In these plants power cranes, hoists, etc., are not practical because there is seldom any use for them. When such work is to be done it is usually performed by a large number of the workmen who are taken from their regular work for this purpose. This results in a loss of time, not only the actual time required to do the work but because such labor tires the men so that they will not be able to put forth their best efforts for the balance of the day.

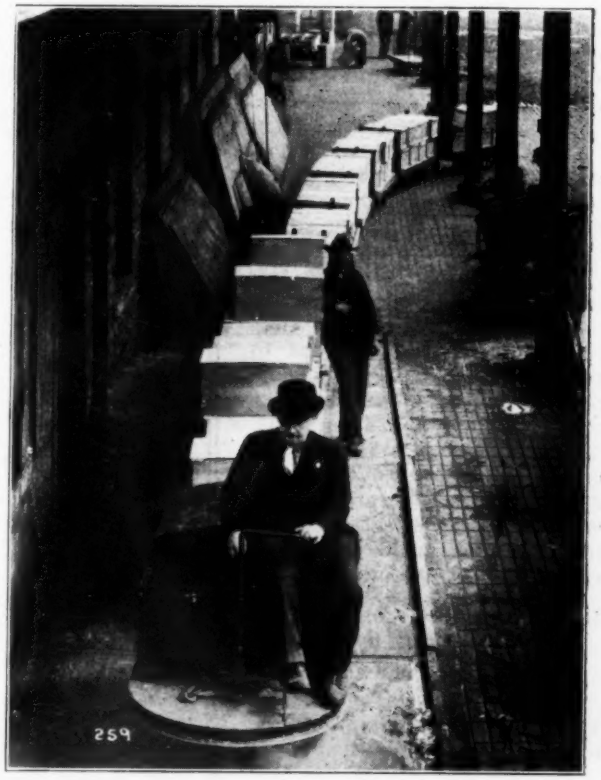
One of the common utility duties that tractors or trucks are required to perform is placing and spotting freight cars. Except in the very large plants where steam locomotives are constantly in use this is an expensive process. How often does the entire receiving or shipping department of a small plant remain idle waiting for the switch-engine from the railroad company to move a car a few feet or wait until several of their number accomplish this task by main strength? While it is not the intention to present the industrial tractor as a possible competitor of the steam engine they can move an empty freight car short distances without seriously overloading their equipment.

As the electric truck and tractor are each designed for a different purpose, neither can be used to best advantage in the work of the other. The locomotive, or tractor, is made to draw trailers and similar apparatus, consequently, special attention is paid in their design to properly equip them for this work. Trucks are built to carry material, etc., and therefore more attention is given in their design to the features which will better equip them for this purpose. They will, of course, permit an occasional interchange of work, but for constant use can not operate efficiently except for the purpose for which they were built and for this reason it is strongly recommended that they be used only for their own work.

Up to the present time, the central-station companies, contractors and dealers have not taken much interest in the introduction, sale or development of industrial electric traction equipment. This is rather unusual as these firms have established an enviable reputation for progressiveness and for promptly accepting and pushing new appliances and since the possibilities for increasing loads and sales profits are as great in the traction field as in any other. Also, a large part of this field is still undeveloped and lends itself particularly well to the efforts of these firms.

The nature of the service which traction equipment renders is such that it often requires the knowledge and ability of a salesman to bring a prospective purchaser to a full realization of its possibilities. Their introduction therefore can be much more quickly and easily accomplished by the supply house or central-station salesman as he is usually well acquainted with the customer's methods and needs and the customer will place more confidence in his advice.

As a load for central-station companies they are ideal. The battery charging is usually done at night during the off-peak period when any load is especially desirable. While this load is not large, being equivalent to about 9 kw. for a 2-ton truck, this off-peak feature and the fact that no power is used from the supply lines during the day or at other times when the load is large has caused many central stations to make



Tractor Hauling Long Train of Tractors Under Difficult Conditions.

special rates for charging service, which indicates the value which these companies place upon this load.

Another possible advantage which they offer to central stations is that the use of tractors or trucks will often serve to introduce central-station service into plants generating their own power.

The Origin of Electric Rate Control

First of Twelve Articles on Electric Utility Valuation and Rates — Timeliness of the Subject—Evolution of Public Utility Regulation—Determining the Utility's Investment

By CHARLES W. McKAY

Chief Appraisal Engineer for the Cooley & Marvin Co., Boston, Chicago and Toronto.

WE, who have followed the electric rate situation with such tense interest during the war period, have asked ourselves many a question regarding the future of the electric utilities. The answer to these questions was somewhat problematical up to Nov. 11, 1918—the date of the signing of the armistice. Even during the past few months many of us have wondered as to the future of the various electric industries.

A year ago all of the electric utility interests were confronted with, to put it mildly, an exceedingly intricate problem. No matter how efficient a utility manager may have been, he was handicapped by the fact that operating expenses were rapidly increasing and operating revenues were, at the very best, remaining constant. In many cases the revenues were decreasing.

The seriousness of this whole situation was recognized by that wizard of electric utility finance, Samuel Insull, president of the Commonwealth Edison Co., of Chicago. Through Mr. Insull's efforts, the precarious position of the American electrical utilities was brought to the attention of Mr. McAdoo, then Secretary of the Treasury of the United States, and Mr. McAdoo, in turn, submitted the matter to President Wilson. As a result, measures were adopted which to some extent alleviated the difficulties which perplexed electric utility executives.

Increased Costs of Utility Supplies and Operating Expenses in General.

Few of the readers of this article are not familiar with the intricacies of the unusual problems presented during the first few months of the year 1918. However, to review the situation briefly, it may be said that the cost of fuel had increased between 90 and 150% during the several years previous to 1918 while the cost of operating supplies and materials had increased between 35 and 700%. A further illustration of the extraordinary increase in material costs is given in Table I. This table was compiled by the New York Public Service Commission and has been taken from sworn evidence produced in the case heard before the Commission in the year 1917.

Another problem which, during the war period, proved most embarrassing to the electric utilities was that of labor costs. Again, taxes on both industrial and electric utility interests were materially increased. These factors all tended toward an additional operating burden on the companies.

To illustrate what the average utility company was confronted with during the war period, the writer reproduces herewith an analysis (Table II) showing the comparative results of operation of public utilities companies giving electric and gas service and also electric transportation service. This table covers the years 1914 to 1917, inclusive. The figures speak for themselves.

Now, fortunately, the war is over. Unfortunately, however, we who are interested in the electric utilities are still confronted with many of the war problems. There is one bogey which has been entirely removed and that is the question of government control—possibly superseded by government ownership—of the electric utilities. Our telephone and telegraph contemporaries are less fortunate—their fate is still for a time in the hands of our worthy Postmaster-General.

Now that we are settling down to a post-war condition, it behooves us to face every issue squarely; to consider most carefully all of our present problems and the best possible means of their solution.

It is this thought that has prompted the editors of the Electrical Review to provide a Rate and Valuation Department designed to afford the readers expert opinion upon electric utility rate and valuation problems, gratis.

The prime objects of this department are twofold: First, to afford the reader a discussion of rate

Twelve Articles on Central-Station Rates and Valuation.

UNDOUBTEDLY one of the most important problems confronting the electric utilities today is that of securing rates adequate to meet not only the abnormal conditions which have prevailed during the war but also the exigencies of the present post-war readjustment program.

It is this thought that has induced the editors of the Electrical Review *to institute a "Rate and Valuation Department"—the function of which will be to supply general information on the subject of electrical utility rates and valuation to the managers of electrical utility properties.*

The scope of this department will be threefold:

1. A series of articles discussing in detail the subject of electric utility rates and values.

2. A discussion of current rate cases with a view to pointing out their possible application to the readers of the Review.

3. A clearing house for questions which may occur to the readers of the department as to the administration of their own rate and valuation problems.

We have retained Charles W. McKay, chief appraisal engineer of the Cooley & Marvin Co.—one of the leading engineering firms in this country engaged in utility work—to conduct this department. Mr. McKay has devoted many years to appraisal and rate investigations involving various classes of utility properties.

Mr. McKay's work in conducting the Rate and Valuation Department will be greatly facilitated through his connection with the Cooley & Marvin Co. Harold A. Marvin, of this firm, has had extensive experience in problems involving the accounting and auditing of electric utility companies. These problems are bound to be closely associated to that of valuation in the determination of electric utility rates. M. L. Cooley, the president of the company, is a lawyer and thoroughly conversant with the legal phase of business administration. Legal problems are inevitably interwoven with engineering and accounting problems in the proper determination of electrical utility rates.

problems as they come up from time to time.

Second, to give him an adequate conception of the inseparably allied problem of valuation. Rates must nowadays always be predicated upon values.

In the present series of articles, it is proposed to discuss the subject of electric utility values first and then the subject of electric utility rates. The reason for this order of presentation will be obvious when it is remembered that the price asked for any commodity must, of necessity, be based upon the cost of manufacture of that commodity.

Origin and Evolution of Public Utility Regulation.

Many of us labor under the delusion that this whole question of rates and values is a product of the 20th Century. It is interesting to note that our ancestors, even as far back as the 13th century, had given some thought to the question of the regulation of prices charged for what were then considered necessary commodities. During the 13th century the English government took upon itself the task of exercising a more or less rigorous supervision over what it considered public necessities.

Of course, at that time our present so-called public utilities were nonexistent. There were no telephones and no electric light or railway systems. The government therefore confined its activities to the regulation of the prices charged for such commodities as foodstuffs, tobacco and ale. This early form of government supervision lasted but a short time and the reasons underlying its inception and subsequent abandonment are most interesting. In the 13th century business, or "trade" as it was then called, was looked down upon by the more intellectual classes. The result was to relegate the dispensation of the commodities heretofore named to a class of tradesmen who were, to say the least, unscrupulous—the Jewish element predominating. There was, therefore, little competition since there was a certain spirit of fraternalism among the dealers in the aforenamed commodities. Later, however, the "trade" gradually developed into "business" and the educated classes who had heretofore looked down upon commercial enterprise began to participate therein. Competition resulted.

Hence, the monopoly instituted by the comparatively small and unscrupulous trade classes of the 13th century called forth a certain amount of governmental supervision or regulation.

Later, as the field broadened with the influx of the educated classes into the realm of commerce, competition became more keen, and the need of governmental supervision became more or less superfluous. However, there is one branch of paternal regulation instituted by our British ancestors which may be regarded as a progenitor of our modern public service commission form of control. During the 15th century an act of the English Parliament established a uniform tariff for boat hire on the River Thames in and about the city of London. This act stipulated that schedules of rates should be posted in public places. Furthermore a committee, whose functions corresponded very closely to the duties of our modern public service commissions, was appointed by the mayor of London to act as a commission to settle all complaints. As a matter of fact, the committee was composed of the aldermen of the city of London.

Not long afterwards an act of Parliament prescribed a definite schedule of wagon freight tariffs. The authority for enforcing these tariffs was relegated to the county judicial authorities.

Perhaps the first forerunner of the modern public service commission in our own country was the board appointed by the colonial governors to supervise the prices charged for foodstuffs, liquors and tobacco. This board was established by laws enacted in the assemblies of a number of our original colonies. Later, several of the colonies enacted laws enforcing the adoption of "fair charges" for various classes of mechanical labor.

It is most interesting to note that despite the early regulatory measures, all attempt at governmental regulation was subsequently abandoned. This, as in the case of the early English regulatory attempts, was due to the fact that keen competition eliminated the necessity for governmental regulation.

Many years later, however, scientific development evolved an entirely new class of essential commodities. The invention of the steam engine, the development of electrical energy, the invention of the telephone and countless other products of the inventive genius of the 19th century gave rise to a group of industries which year by year have become more and more essential to our civic and economic growth. It is but natural that these industries should be subject to some form of federal, state or municipal control. We all realize this fact but possibly its significance may be more apparent with the aid of a simple illustration.

A man may buy a pair of shoes; if he does not like the shoes, he has the privilege of trading in some other store and buying some other make of shoes. However, a man living in the suburbs of a town or city who is dissatisfied with the electric or steam train service between that town and his place of business may not transfer his patronage to another line, at least without appreciable inconvenience.

Take our own case as an illustration. We may have very definite and well founded ideas as to the operation and regulation of electric utility companies; nevertheless, let the telephone company or the street railway company, upon whom we are dependent for service, transgress one iota upon what we consider to be our service rights and we are at once up in arms.

Development of Commissions and Rate Regulation.

Hence, it is but natural that all of these most essential factors to our 20th century civilization should be subjected to some form of regulation, and I think even those of us who have a grievance against the local public service commission will admit the justice of such a policy. Furthermore, a fair and just commission is just as beneficial to the electric utility interests as it is to the public. Any fair-minded commission is predisposed to safeguard the interests of the utilities and in most states the laws which have been responsible for the establishing of such commissions are so constituted that they, the commissions, are in duty bound to give equal attention to the rights of both the utilities and the public.

With the rise of the commission method of public utility control there came the need for adequate methods of determining whether the utilities subject to commission jurisdiction were charging exorbitant rates or whether the frequent complaints on the part of the utilities that they were operating under inadequate service rates were justifiable. Naturally the commissions were obliged to determine some method of gauging the reasonableness of electric utility rates. As in all other industries, a rate charged for a product must be largely dependent upon two prime factors:

First, the cost of manufacture;

Second, investment in plant.

The problem of investigating operating costs proved comparatively simple, even to the pioneers in the field of public utility jurisdiction. The problem of determining investment was much more serious.

TABLE I.—INCREASED COST OF MATERIALS.

Nature of material or equipment.	Source of Information.	Period Covered.	Per Cent of Increase in Cost.
Motors and car equipm't	New York State Public Service Commission	1914-1917	65
Air brakes			60
Rotary converters			50
Transformers			60
Switchboards			75
Motor-generators			55
Turbogenerators			100
Pig iron			250
Steel plate			700
Copper			120
Steel castings			90
Steel forgings			350
Spelter			90
Brass			190
Crude rubber			60
Mica			140
Insulation material			50 to 150
Fuel oil			60 to 65
White oak ties	"Electric Railway Service," Detroit.	1914-1916	22
Copper trolley wire			74
Motor equipment			37
High-speed steel			235
Brass castings			80
Gray iron castings			32
Steel castings			50
Cement			60
Leather belting			41
Cast-iron machinery			37
Pig iron			54
Copper wire	"United Railways Bulletin," St. Louis.	1915-1917	180
Cast-iron pipe			100
Car forgings			216
Malleable castings			198
Composition castings			173
Bar and sheet copper			147
Drills			192
Lead, pig and sheet			127
Tool steel			400
Tie plates			276

Determining Investment and Plant Value.

Few of the members of the early public utility commissions were possessed of any knowledge of electric utility values. The first thought that suggested itself to these early commissions was that the bond and stock issues would reflect an accurate measure of the true worth of the properties under their jurisdiction. It soon developed, however, that things were not always what they seemed. Companies were frequently overcapitalized and in some cases undercapitalized. The term "water stock" was much more prevalent in those days than it is now.

Abandoning this method, however, of determining utility values, the commissions next turned their attention to the investment as presented by the companies' own records of value as shown by the books. Here, again, the commissions were confronted with countless difficulties. Book values were often found to be most misleading and rarely did they afford a true index of property values. One reason for this will be apparent when it is remembered that years ago many electric utility companies followed the questionable practice of charging to operating expenses many items which should have been charged to the capital accounts. In prosperous years companies would invest comparatively large amounts in new pole and wire plant and in new machinery and charge this investment to operating expenses. Hence, when the commissions came to investigate the books and records of the company to determine the true worth of the fixed capital assets, they were confronted by a maze of misleading data and it would be well nigh impossible to determine the true investment in the capital accounts.

Next in this evolutionary process came the thought that if one could but make an accurate and complete inventory of the physical assets of the plant and price out of this inventory by reference to the company's invoices, to show the actual original cost of the items which they represented, the results would reflect an accurate index of the original investment. Here, again, the commissions were confronted with well nigh insurmountable difficulties. In many cases it was found that records of the original cost had been lost or destroyed by fire. Again, as in the case of an attempt to gauge the value of a property from the book values, it was found that many charges, which should have been made to the capital accounts, had in reality been made to the operating accounts.

All this pioneer work in the field of utility valuation, while most instructive to the investigators, resulted in little or no progress toward the ultimate goal—that of determining a fair value of the properties under consideration. It served one purpose, however—that of evolving the reproduction-cost theory which has since been used almost universally in the appraisement of utility properties.

In this connection it is interesting to note that the Supreme Court of the United States, in a justly renowned case, handed down an opinion which was substantially as follows:

"There are three elements to be considered in the determination of the value of a utility property; these elements are:

"1. Original cost *where obtainable*.

"2. Reproduction cost.

"3. Present value."

The significance of the words "where obtainable" which are used to qualify item No. 1, original cost, will be apparent from the foregoing discussion of this phase of the subject.

The reproduction-cost method is most ingenious and even its worst enemies admit that it is practically the only method of determining the fair value of the electric utility property where there is no clearcut, authentic record of original cost.

The reproduction-cost method will be discussed in the ensuing installment of this series.

TABLE II.—COMPARATIVE RESULTS OF OPERATION OF PUBLIC UTILITY COMPANIES FURNISHING ELECTRIC AND GAS SERVICE AND ELECTRIC TRANSPORTATION.

	Gross earnings from operation.	Increase in gross earnings over previous period.	Operating expenses, including taxes.	Increase in operating expenses over previous period.	Operating ratio.	Increase in operating ratio over previous period.	Gross income from operation.	Increase in gross income over previous period.	Increase in investment account over previous period.	Increase in gross income over previous period on old capital if new capital had earned 8%.
Year ended—										
Nov. 30, 1914	$313,070,488	.....	$194,585,084	.....	62.15	.....	$118,485,404	.....	.....	.....
Nov. 30, 1915	318,710,359	$ 5,639,871	195,241,406	$ 656,322	61.26	*0.89	123,468,953	$4,983,549	$53,898,971	$671,632
Nov. 30, 1916	353,869,562	35,159,203	221,447,733	26,206,327	62.58	1.32	132,421,829	8,952,876	70,047,980	*962,880
Nov. 30, 1917	396,170,942	42,301,380	270,752,138	49,304,405	68.34	5.76	125,418,804	*7,003,025	108,164,910	*25,571,973
6 months ended—										
Nov. 30, 1916	179,400,102	.....	113,787,528	.....	63.42	.....	65,612,580	.....	.....	.....
Nov. 30, 1917	201,143,871	21,743,769	140,127,680	26,340,158	69.67	6.25	61,016,191	*4,596,389	61,646,947	*13,880,863
3 months ended—										
Nov. 30, 1916	94,524,566	.....	59,215,496	.....	62.64	.....	35,309,070	.....	.....	.....
Nov. 30, 1917	105,973,001	11,448,435	73,761,778	14,546,282	69.61	6.97	32,211,223	*3,097,847	32,504,508	*7,740,084

*Note.—Figures marked * are negative.

Electric Furnace and the Central-Station Industry

Central Stations Are Awakening to Its Possibilities—Small as Well as Large Utilities Can Develop this Form of Load—Big Opportunity that Is Worth Developing

ELECTRIC furnaces for melting steel are no longer looked upon as pieces of apparatus that are being recommended by central stations because they consume current. Instead, the electric furnace is looked upon as a piece of apparatus that has answered a need in the steel industry. The electric furnace has made rapid progress, not because it is advantageous to the electrical industry but because it meets a want in the steel industry. It is, however, true that to the central station industry is due a large amount of credit for what it has done toward making the electric furnace commercially practical, for improving it and for supplying cheap and reliable power, without which the electric furnace would not have attained the importance that it has today.

Every central station company is deeply interested in load building, and especially upon improving its load so that peak loads are made less conspicuous by the filling in of the valley in the load curve that occurs during the night and those hours when there is little demand for light or power. The electric furnace load accomplishes these things to an extent that has encouraged central stations to look upon this form of load as a worthy one. Today there are approximately 300 electric furnaces employed for the production of steel, and of these the majority obtain their power from central station supply. Many more furnaces are to go into service shortly, and are now in varying stages of erection. And the demand is not yet filled. It can be seen therefore that supplying electrical energy to these electric furnaces offers many possibilities, and opens up a big opportunity to the electric supply company.

Electric Furnace and the Foundry.

While some of these furnaces are installed in the large steel plants, by far the greater number are to be found operating in the steel foundries. That this is so is not only because there are more small and medium-size foundries than there are large steel plants, but for the reason that the steel foundry has found the electric furnace particularly well adapted to foundry application. This is, of course, to the advantage of the central-station industry because the steel foundries that make castings from steel are to be found more widely and more generously scattered about the country than are the plants that make the steel from the iron ore. This, in turn, means that

View of Foundry of Standard Steel Co., Showing Electric Furnaces.

opportunity is offered to more central-stations to develop the electric furnace load than would be the case were the electric furnace installed only for the purpose of making steel from ore.

The electric furnace for melting steel, almost invariably implies more than at first appears; at least that is the experience of most of those central stations that have cultivated and gone after the electric furnace load the most seriously. As has already been pointed out, the electric furnace has found its greatest demand among the steel foundries, which is where castings are made and scrap metal refined. Comparatively few foundries operate their own individual power plants where electric furnaces or even one furnace is employed, because the energy consumption and peak demand of the electric furnace is high, necessitating large capacity being available to take care of the sudden short circuits that take place during furnace operation. Foundries that had their own power plants up to the time of installing electric furnaces, shut them down or maintain them for stand-by service and go over to central-station supply.

It may be taken as a truth, that when a foundry puts in an electric furnace, it also electrifies its foundry, if not immediately, very soon afterwards. It must be so, because the foundry with the electric furnace has adopted modern methods, and no foundry is modern unless equipped with electrically-operated cranes and hoists, motor-driven blowers, etc., while such refinements as electrical temperature measuring apparatus, molding machines, and electric welding equipment for building up faulty castings are rapidly finding a wider and wider employment. It is for these reasons that the company going after the electric steel furnace load finds it also increases its load usually called "power" load.

Electric Steel Furnace Characteristics.

The operating characteristics of the electric furnace are those that tend to cause difficulties for the operating company. The usual characteristics of the electric furnace are such that half rated load is about the minimum that will occur, while momentary swings of current often reach 250% of full load rating. The widest variations in power occur during the melting down period, when the cold steel scrap and ingots melt and readjust themselves, causing short circuits one minute and light loads and even open circuits the next. Such current variation makes itself felt, and tends to create voltage regulating difficulties on other sections of a central station system unless the electric furnace load represents only a fraction of the total load carried by the system.

In the past the electric furnace frequently possessed a very low power-factor, around 50%, because of the large amount of reactance and inductance of the conductors. However, at the present time, power-factors in the neighborhood of 90% are commercially obtainable, very largely due to the fact that the two- and three-phase furnace using a short arc are replacing the single-phase type employing a long arc. Apart from the fact that power-factors are now higher than used to be the case, central stations can feel satisfaction that the two- and three-phase furnaces are replacing the single-phase type, because the severe unbalance that was caused by the single-phase furnace upon a three-phase system no longer exists, thus eliminating the chief objection to the furnace load, and doing away with the necessity of installing phase balancers and similar apparatus that added to the cost and complication of service.

The fact that quite high power-factors and balanced phases may be obtained, does much to do away with the deterrents that may have tended to cause the smaller central stations to feel that they could not advantageously encourage the electric furnace to come to their lines. At the same time, the smaller utilities must bear in mind the fact that the electric furnace load is a rapidly and widely fluctuating load, very similar in effect to temporary short circuits at times.

Plant.	Product.	Furnaces.	Monthly consumption, kw.-hr.	Load-factor, %.	Avge. rate, cents per kw.-hr.	Max. demand. kw.
Electric Steel Co.	Steel castings	1 1-ton 1 2-ton 1 3-ton	6 to 700,000	40-50	.01	2800
Trojan Steel Co.	High-grade tool steel	1 1½-ton				
McCord & Co.	Railway castings	2 7-ton	1,000,000	43	Little less than 1c	3552
Denny-Rine Co.	Brass castings	1 1-ton		Just installed		
Consumers Steel Co.	Steel from scrap	1 1-ton 1 3-ton		Just installed		
Crane & Co.	Steel castings	1 3-ton				
Pettibone-Mulliken Co.	Re-melting rail manganese scrap	2-ton		Just installed		
Chicago Bearing Metal Co.	Bearing metal	2 1¼-ton 2 1½-ton	350,000	29	1.16	1759

Electric Furnace Power Rates.

Steel foundries are so widely scattered and are so numerous that many central stations have the opportunity to go after the electric furnace. The first thing necessary in doing this is to determine what such a load implies and how it will affect the system. The second thing is what will such a load represent, as a load builder, as a producer of revenue.

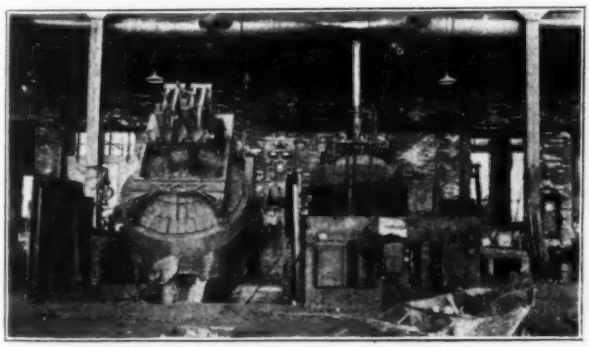
It is a simple matter to determine, and quite closely, what will be the effect of the electric furnace upon the central station system, because the installations are many and performance of the furnace can be quite closely predetermined. On the other hand, it is not so simple a matter to foretell what revenue will be derived, the kilowatt-hours consumed, or the load-factor; yet it is upon these things that energy rates should be based. And the cost of power is the all-important thing from the viewpoint of the furnace operator or the foundryman.

One of the companies that has done much to develop the electric furnace load is the Commonwealth Edison Co. Today this company has eight furnaces in operation while three years ago they had only two or three. The table shown above indicates to some extent what this load represents as regards monthly energy consumption, load-factor and maximum demand. In studying this table it should be borne in mind that many of these, probably all of them, have been engaged upon war work. On the other hand, the growth such as that of the Electric Steel Co. where the furnaces installed have increased from one 1-ton unit to a 2-ton and lastly to a 3-ton, indicates that the electric furnace for the steel foundry is a commercial success and its owners are optimistic.

Electric power rates usually include a charge based upon maximum demand as measured over a definite period; and a charge for the kilowatt-hours consumed during a definite period, usually one month. The first of these charges takes care of the generating and transmission equipment actually required for the load, and its fixed and maintenance costs, the second for the fuel, labor, line loss and incidentals necessary for furnishing the power. The energy rate for the electric furnace must be low, otherwise the furnace will not only be not encouraged but discouraged. The central station can afford to give a low energy rate, preferably a sliding scale so that the greater the energy consumption the lower the cost per kilowatt-hour. When this is done the foundry is encouraged to operate a high load-factor, which may mean twenty-four hour operation instead of nine or twelve hours, thereby helping to fill in the valley of the load curve during the night.

Where 24-hour operation is not possible, there are often advantages in keeping the furnaces heated up, although not actively engaged in making steel. By cutting down the energy input to the furnace to about 10% of normal, high temperatures are maintained and the furnace is ready to start melting when the working day starts, the kilowatt-hours per melt are reduced, refractories have longer life and the additional energy used tends to create more favorable rate.

It is during the last two or even three years that the electric furnace has accomplished most, the war creating the great incentive for installing electric furnaces. As war work was abnormal, it follows that most of the data obtained on electric furnace operation, energy consumption, load-factor, etc., may not represent conditions as they will be from now on. While the central stations serving electric furnace do know the load-factors of these installations during the war, they do not know to what extent these load-



Electric Furnaces Installed in Lumen Bearing Co.'s Plant.

factors will continue to be the same. Electric furnace may replace other types to some extent, thus maintaining load-factors and kilowatt-hour consumption with a smaller total production of steel or not. To what extent this happens is dependent upon the aggressiveness with which central stations cultivate the electric furnace load. Under these circumstances it can be realized that the central-station companies are hardly justified in making long-time power contracts since the cost of fuel, the cost of labor and furnace demand may change electric furnaces where the cost per kilowatt-hour decreases as consumption increases power rates, which is what some of the largest central stations are doing today, the matter of load-factor, etc., are taken care of without hardship to either foundry or utility.

For the electric furnace to make rapid headway, electricity supply must be cheap. And it must be reliable. Under conditions encountered by the large majority of steel and brass foundries, central-station service is cheaper than service derived from the isolated plant. Moreover, it is more reliable. While cheap power is necessary, experience has shown that steam power is well able to compete with water power; in fact, the companies having the largest electric furnace loads are steam power-systems entirely, a situation explained by the fact that water power is not always located favorably to industrial centers.

Conclusion.

The electric furnace possesses such vast opportunities for the central station industry as a whole that it would seem no opportunity for cultivating this form of load should be missed. However, this does not mean that any central station can go blindly into the business of supplying electric furnaces promiscuously. The problem is a specialized one, and those companies that have done most in developing the electric furnace load, and to make this load a success, appear to be doing most toward placing this load upon a standardized basis. Every central station wants to increase the kilowatt-hours sold and thus increase its revenue. It wants to improve its load-factor and thereby utilize its equipment as many hours as possible. The policy today is to sell large quantities of a product at a small individual profit rather than small quantities at a large profit. Applied to the electric furnace this means that there should be a large consumption of kilowatt-hours at a low cost per kilowatt-hour.

In taking on the electric furnace, success depends upon recognizing several pertinent facts. The load is a fluctuating one with extreme current surges. Central station capacity must be sufficient to take care of these without service interruptions, and without interfering with other customers. The service must be reliable and the rate low. To what extent many of these are accomplished depends upon the central station, the care and thoroughness with which the load is canvassed, and the installation made. While it is vitally important for every central-station company concerned that each electric furnace installation upon its lines be laid out upon sound engineering principles and that it prove successful, it is also a matter of concern to the entire central-station industry since every success means more success while every failure tends to set back somewhat the electric furnace somewhere.

That the electric furnace need not be confined to the lines of the largest companies is a fact worth emphasizing. On the other hand, the smaller company must necessarily give such matters as ratio of furnace demands to system capacity, power-factor, voltage regulation and reliability, more weighty thought than the larger company where such problems take care of themselves to a certain degree. It is hoped that what has been said here will prepare the power engineer and central-station companies for the report and discussion on electric furnaces that will undoubtedly be presented at the N. E. L. A. Convention next week. Only a very general survey of the electric furnace and the central-station industry has been made. But this when read will serve, perhaps, to give a better understanding of the problem as it appears to be today. With this accomplished, those attending the Convention or reading its reports will be in a more receptive mood to give the report on electric furnaces the thought and weight it will undoubtedly deserve.

Campaign for Improving Factory Lighting

Marked Progress in Industrial Lighting During the War—Why It Can and Should Be Further Stimulated—Why the Central Stations Should Actively Participate in Campaign

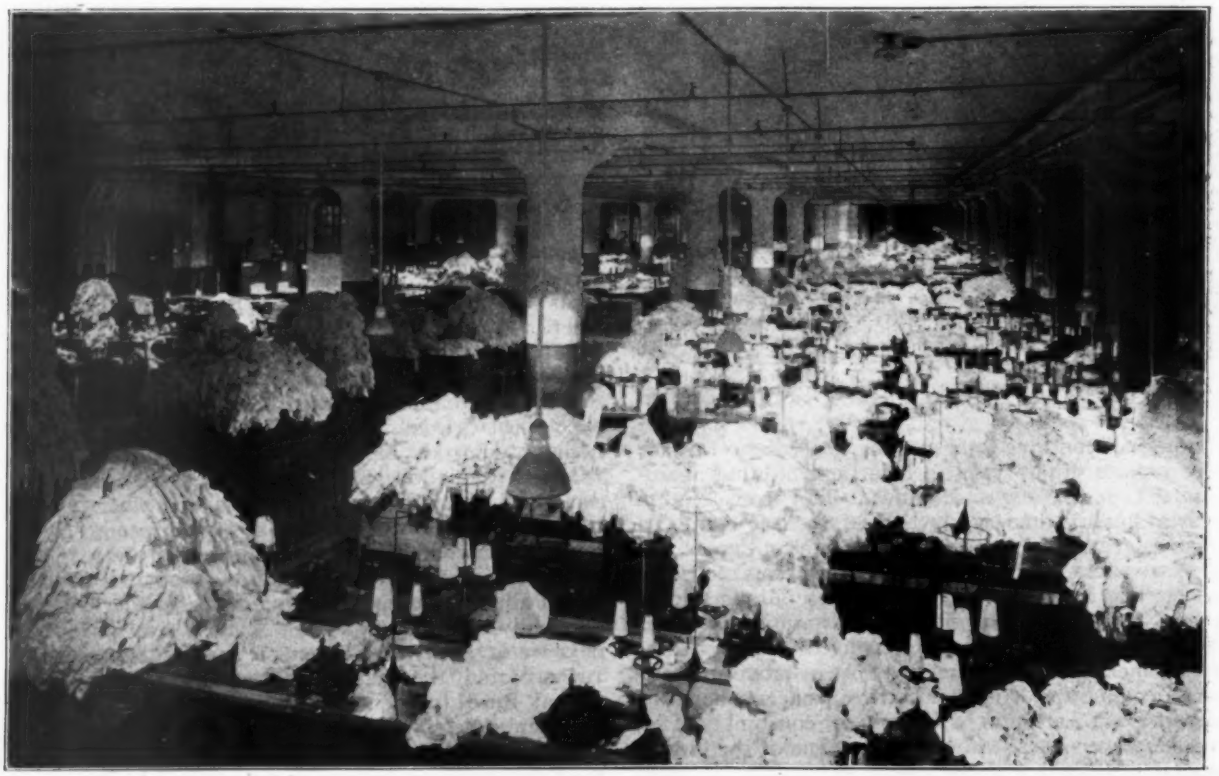
LIGHTING curtailment as invoked during the recent war had as its results, from the public standpoint, decided psychological effect and less important fuel saving, while from the standpoint of the lighting industry it checked development in every important branch of the lighting business except that of industrial lighting. The latter, instead of suffering, actually made considerable progress, to the great benefit of the nation, the manufacturers, the factory workers, the producers of lighting equipment and the central stations. It is the aim of this article to show that great good will come to all these interests by actively stimulating further progress in factory lighting betterment and that the central stations may well take a leading part in this effort.

Recent Developments in Factory Lighting.

Urgent need for shipping and for military and naval supplies was the chief reason for the radical improvements in lighting that were effected in so many plants that were directly or indirectly concerned with their production. Scarcity of and high cost of labor was a contributing factor. Plant managers in the war industries realized that no time could be wasted and that existing or additional facilities must be utilized to the utmost. The installation of modern electric lighting systems eliminated the loss of production due to cloudiness and storms, it permitted overtime work and made operation with two or three shifts not only possible but practical. Many plants operated continuously 24 hours a day and found that the production during the night hours was substantially equal to that by day.

The war therefore furnished a most effective demonstration of the value of scientific factory lighting. Improved general efficiency was observed among the workmen, spoilage and accidents were reduced and the general morale of the organization was raised so that the combined result was a marked increase in production in spite of depleted and diluted forces. Continuous operation with several shifts in many cases trebled the output from existing plants with practically no additional investment; at a time when capital, building materials and machinery were difficult to secure this intensified utilization of plants proved a great boon to industry that would have been entirely unobtainable without effective lighting.

Aiding in the improvement of factory lighting were important developments in the design of reflectors, especially of the porcelain-enamelel steel type.



General Lighting of Sewing Tables in Knitting Mill—A Cheerful ly Lighted Room Like This Stimulates Alertness and Increases Production.

Several new types were produced and a standardized type of dome-shaped reflectors was developed. At the same time there were produced new types of diffusing or glare-eliminating auxiliaries, such as opal glass caps and bands and opaque silver caps that serve to diffuse or cut off entirely the direct light from the brilliant filament. As a fuel-conservation measure, the use of carbon-filament lamps was greatly restricted and both these and many obsolete arc lamps were replaced by the much more efficient Mazda lamps.

The value of good factory lighting and the dangers of inferior lighting have, moreover, come to be recognized by governmental authorities. During the last few years much progress has been made in the drafting and adoption of industrial lighting codes. In four states—Wisconsin, Pennsylvania, New Jersey and New York—such codes are being enforced, and in at least four other states they are being drafted or are practically ready to be put into effect. In all cases these codes lay down minimum intensity requirements and make other stipulations to insure that factory lighting be at least not dangerous to the safety of employes or injurious to their eyesight. These codes are most effective in directing definite attention to the subject and, while they do not ensure that a high-intensity, modern, productive lighting system will in all cases be installed, at least they are the doom of the old gloomy shops and serve also to make it easier for the lighting salesman to present his case.

Why Development of Factory Lighting Should Be Pushed Further.

From the foregoing hasty review of what took place in the last few years, it is evident that betterment of factory lighting received a decided impetus. It is firmly believed that the momentum which has been achieved should not be allowed to slacken, rather the opposite. Improvement should be accelerated and modern industrial lighting ideas introduced in industries and plants where they have not yet made headway. Conditions are, or in a few months will be, favorable to focusing interest on this subject. Manufacturers are already in large numbers aroused to the importance of considering factory lighting and many are keen for further developments, having become completely "sold" on the advantages to be derived therefrom. The governments of the industrial states are waking up to taking an active interest in factory lighting betterment. The lighting equipment for effecting this betterment was never so completely and highly developed. Definite information and conclusive data on the value and cost of providing good lighting are available as never before.

Moreover, in the opinion of well informed business men, conditions are becoming ripe for an intense revival of general business and a period of unexcelled prosperity. The indecision due to the belief that high prices would suddenly come tumbling down with the signing of peace is giving way to the conviction that the period of high prices is here for a prolonged stay. Consequently buying is being generally and liberally resumed. During the last few months building has been revived in many sections of the country, especially as to dwellings.

As to the future, the prospects are very bright. Crops are reported to be in splendid condition and the prosperity of the farmer is likely to continue and help that of the nation. Our foreign trade is steadily growing and doubtless will make further gains because we are better fitted to supply the world's needs than any other country. These facts and the gradual loosening of the purse strings of the average citizen are bound to create enormous demands on all manufacturers who, as a rule, have been carrying low stocks of finished goods. If this analysis of the situation is not merely visionary, we should expect by the early fall, if not earlier, to see a revival of manufacturing activity that should excell that witnessed up to the signing of the armistice. The cry for intensified production may therefore again be heard. Keener competition than ever will require every effort to raise manufacturing efficiency to the highest possible point.

At about the same time the days will steadily shorten and near the close of October the extra hour obtained through "daylight saving" will suddenly disappear. Consequently, the need for the best possible factory lighting will be urgently felt and conditions for securing favorable and prompt consideration of lighting betterment should be almost ideal. To fail to push this lighting development under these circumstances would manifestly be outright neglect of most favorable opportunities.

Why Central Stations Should Take Active Part in Campaign.

That these opportunities will not be neglected is quite certain, for the manufacturers of lamps and lighting equipment at least will keep pushing ahead in their efforts to modernize the lighting of all manufacturing plants. Electrical jobbers and contractors will also participate to a greater or less extent and there is no reason why the central stations should not do so. In fact, there are reasons why they should take a leading part.

Industrial load, both power and lighting, is steadily swinging over to central-station service. The power and lighting companies are logically, therefore, more continuously benefited by the factory lighting load than are the lighting equipment manufacturers, dealers or installers. This is recognized by some of the most progressive central-station companies, who have spared no pains or expense to secure data and demonstrations on the productive value of modern lighting. Especially noteworthy in this line is the series of tests conducted by the Commonwealth Edison Co., of Chicago, and reported in the Electrical Review of March 22, 1919. Significant also is the fact that W. A. Durgin, of this wide-awake central-station organization, will give a very effective demonstration of productive factory lighting at the Atlantic City convention of the National Electric Light Association next week, which should awaken other central-station executives to the possibilities in this line.

The central stations should take a leading part also because by doing so a better lighting system will be secured than if left exclusively to some of the other electrical interests. Experience has shown that excessive competition between some of these leads to laying out a system that can be installed at the lowest initial cost in order to get the contract or make the sale, but that this does not always mean the best designed or most effective lighting system. The central station, on the other hand, can afford to design a system incorporating the best illuminating engineering practice because its resources usually are extensive and it can engage proper engineering talent.

Active participation, if not actual leadership, in the campaign for further improvement of factory lighting may well be expected of the central stations in industrial communities. The industries need more and better light—the lighting companies can and should furnish it.

The Problem of Financing Public Utility Companies

Public More Interested in Utility Stocks Than Is Generally Realized—Maintenance of Credit—Other Factors

By CHESTER COREY

Vice President, Harris Trust and Savings Bank, Chicago.

IN spite of the emphasis which has been laid upon the quality of service, the value of the public's good will, and kindred matters, proper financing, which means the maintaining of a substantial credit and the payment of a fair return on the capital invested still remains the most important factor to be considered in the operation of public utility companies. And this phase of operating is lent added significance by the recently adopted policy of many companies to make stockholders of their consumers. In this article, the vice-president of the Harris Trust and Savings Bank of Chicago explains very clearly the essential features and the more common difficulties which are encountered in this work. While many of the problems in this connection are as yet unsolved those companies having a firm financial framework should not have any difficulty in securing substantial support of this nature.

THE problems which now exist in connection with public utility financing are not only puzzling to corporation managers and to bankers but are serious from the standpoint of the public who want good service, and who are interested to a much greater extent than is generally realized in the stocks and bonds of public utility companies. It will probably surprise many people to know that many bond issues of public utilities are distributed in average holdings of less than $5000, and that there is an average of approximately 250 holders for each $1,000,000 issue of bonds.

A public utility cannot give good service to its present customers, service cannot be extended to new customers, and investments heretofore made cannot be protected against unnecessary depreciation unless the utility can maintain its credit or restore it in case it has been injured or destroyed.

The credit of a company is usually dependent upon the relation of the amount of its earnings available for the payment of fixed charges and the amount of such charges, and while a more favorable condition is always to be desired and is sometimes necessary, a company must earn at least one and one-half times its fixed charges or its credit position is likely to be unsatisfactory.

If a company is without good credit an analysis may disclose that its poor earnings statement is the result of giving service at less than cost, or with too small a margin of profit to support a reasonable and proper capitalization. In such a case relief should come from the people who use the service, who should be willing or who should be required to pay for the cost of the service, plus a reasonable profit.

Plants have been built to give service in territories which because of lack of population could not support the investment, and sometimes faulty capitalization, especially over-bonding, is responsible for lack of credit. In such instances reductions in fixed charges are necessary.

There should be an educational campaign on the fundamental that good service can only be obtained from privately owned corporations by the payment of the cost of giving the service, including a fair return on investments. Even if public utilities are to be owned and operated by the Government or by municipalities, the cost of giving service, including a fair return on investment cannot be evaded, and must be met by the rates charged for service or by taxation.

If a man believes that in the city in which he lives the municipal administration of city finances, the maintenance and cleaning of streets, the control of criminals and other unfortunates, and other city activities are all administered with efficiency and economy, that man has a logical reason for believing in municipal ownership. Most of us believe in private ownership under Government regulation, and believe that the best results, as regards quality of service and the price charged for the service, can be obtained in this way.

There is a great opportunity for discussion as to whether the cost of service as regards a street railway should properly include paving, street sprinkling, snow removal, and interest on such unusual structures as sub-ways and tunnels. That is, should the car rider pay for these wholly or in part, or should they be paid for by the community as a whole, on the theory that manufacturers, merchants, owners of real estate and business men generally are interested in the maintenance of rapid transit facilities and therefore should pay some part of the cost of maintaining these facilities even though as individuals they may not be dependent upon the street cars for transportation.

On the other side, should a car rider pay some part or all of his taxes by paying a sufficient fare to help pay for the construction and maintenance of "streets," surface, overhead and underground? Aside from any academic discussion the welfare of a city depends to a considerable extent on good local transportation which cannot be furnished unless the cost of service is met in full in some way.

A public service corporation should be able to raise money for extensions and additions by sales of both stock and bonds, and in actual practice stock cannot be sold unless a reasonable amount of surplus earnings are also available for capital expenditures.

A company which over a period of years is only able to raise money for capital expenditures by the sale of interest bearing obligations is in an unsafe position unless surplus earnings of considerable amount are being devoted to capital expenditures against which no bonds are issued. In that case the margins of property above debt and of net earnings over interest charges are continually increasing, with the result that dividends on stock can eventually be commenced or increased, with such reasonable expectation of continuance that the stock of the company becomes marketable at a commercial price.

The investing public is in some cases hesitating to put its money into public utilities but nevertheless many companies have received and are continuing to receive fair treatment from rate regulating bodies, and, if their financial framework is not structurally weak, these companies will have little difficulty in financing their necessary requirements.

If in a given case a company is without credit a frank statement should be made that the bankers of the company refuse to make further loans, and for that reason good service cannot be given and extensions cannot be made unless credit is restored by satisfactory assurances that investments will be protected.

ELECTRIC SMELTING POSSIBILITIES IN BRITISH COLUMBIA.

Recent Survey Shows Establishment of Smelting Plant Depends Upon Electric Power Supply.

The future possibilities of the electric smelting of iron ore on the Canadian Pacific coast is described in a comprehensive report on this subject recently submitted by Dr. Arthur Stansfield, professor of metallurgy at McGill university, to the Government of British Columbia. In his report Dr. Stansfield lays down the following essential conditions for the smelting of iron on a commercial scale: (1) A supply of high grade ores at a reasonable price; (2) An ample supply of cheap electric power; (3) A supply of charcoal or other fuel at a moderate price; (4) Labor rates that are not excessive; (5) A suitable location for the smelter; (6) A sufficient market for the resultant iron at a rather high price.

With regard to the plentifulness of ores it is found that British Columbia has adequate supplies of iron of reasonable richness and purity at easily accessible points. These ores are magnetite, which are not suitable for reduction in the ordinary blast furnaces, unless admixed with other ores, but quite suitable for electric treatment. The ore is not of a very high grade, but runs between 50 and 55%, and is free of phosphorus, copper and titanium and the proportion of sulphur may be kept as low as .01%. It can be delivered at the smelter from $3.96 to $4.10 a ton. This would render the smelting of ores rather higher than by the Swedish process in Sweden, a condition which might be offset by magnetic concentration.

Regarding the electric power supply, Doctor Stansfield estimates that from 8000 to 9000-hp-yr. will be necessary for the production of 50 tons of iron daily for a year. Early in the investigation it was estimated by the British Columbia Railway Co., that this power could be delivered for $15 per hp-yr. which would mean that the cost of power per ton of pig iron would be from $6 to $7.50. This estimate was later raised to $27.80 per hp-yr. which would increase the cost of power to $11 to $14 per ton. However, competent electrical engineers have assured the industry that a supply of continuous electric power can be secured for a cost not greater than $10 per hp-yr. which would reduce the cost per ton to from $4 to $5.33. Other essential items such as the supply of fuel and labor present some difficulties under present conditions but these might easily be overcome.

The prevailing market price for iron in this district would warrant the establishment of an electric smelting plant for local consumption if the electric power could be secured for $15 per hp-yr. and these prices are not likely to be reduced during the next few years which would provide an ample margin for beginning operations. The report concludes that the ultimate success of the industry would depend upon the production of special qualities of iron and steel as it would be unable to compete with the blast furnace in the production of the ordinary grades of pig iron. This conclusion, however, is immediately modified by the remark which follows: "If, however, the new process for the reduction of iron ores is found to be satisfactory, it should produce a decided improvement in the commercial status of electric smelting." This new process alluded to is the crushing of the iron ore into a coarse powder to be then subjected to magnetic concentration for the removal of the gangue rock, producing a metallic iron from grain iron at low temperatures, which iron is readily and cheaply convertible directly into iron or billet steel.

SOCIETY FOR ELECTRICAL DEVELOPMENT URGES CLOSER CO-OPERATION.

Interesting Booklet Describing Work of Society Being Sent Out.

The Society for Electrical Development, 29 West 39th street, New York City, is sending out a very interesting booklet entitled "What Licked the Kaiser," which clearly describes the value of co-operation as demonstrated by the outcome of the war. The article also points out the need for continuing and increasing the co-operative methods, which were adopted during war, in the reconstruction and future activities of the electrical industry and explains the work and aims of the Society in this respect.

The Society is an organization built to accomplish for the entire industry work which no individual or interest could afford as a practical proposition to do alone. This work consists of research, popular education through standard magazines and newspapers, industrial and business education, through trade and technical publications, the development of harmonious and profitable relations between the various branches of the industry and between this and other industries, the issuing of various publications and data and the organization and stimulation of nation-wide campaigns.

The Society's success in this work in the past is truly remarkable. "Electrical Prosperity Week" in 1915 and "America's Electrical Week" in 1916 are perhaps the most prominent campaigns which have been promoted and conducted by the Society. By

However, in order to do its work properly the Society must have the co-operation of the entire industry. For this reason every firm should become a member of the Society immediately and they are especially urged to become active members, for in this way they themselves can receive much greater benefits from the Society and in turn be of greater assistance to the Society.

The Central-Station Rate Situation

While Income of Utilities Has Not Been Proportional to Increasing Costs, Hope Is Seen in the Broadening Market for Service—Interconnection a Factor

By A. C. KING

Consulting Engineer and Rate Expert.

FOR several years previous to 1916 the universal tendency of electric rates was downward. This was to a great extent true of all utility rates on account of the widespread movement for state regulation, but was especially noticeable in electric rates. Operators of electric utilities were the first to realize the possibilities of great development by making low rates for large consumers, the accomplishment of which was greatly aided by the rapid and fundamental improvements in the art of power production, transmission and distribution on a large scale accompanied by lower investment and operating costs. The resulting advantages were not wholly confined to the utilities and its large consumers but was shared to some extent by all consumers.

The beginning of the war in 1914 had little effect on these conditions except that plans for many large extension projects were curtailed as a matter of conservation, which subsequently proved rather unfortunate, as they had to be carried out later at much greater cost. Early in 1917 the effect of rising prices began to be very noticeably reflected in the operating expenses of the utilities, although advancing costs of materials and apparatus had previously resulted in curtailment of improvements and extensions.

Great advances in the cost of fuel during the latter part of 1916 and 1917 while seriously effecting the electric companies was even more burdensome to the gas utilities, whose fuel expense is relatively greater. Increases in labor also became a factor to be reckoned with. This item had a much more serious effect on the street railways on account of the relatively large labor expense. Large electric utilities suffered comparatively little from this cause but it added another difficult problem for those operating generating plants in small communities.

At this juncture the great economic advantage of operation of smaller plants on a unified system with power stations advantageously located and with interconnecting transmission lines became so apparent that the many plans were projected to effect such combinations. Difficulty of financing greatly restricted the accomplishment of these projects though some of the more urgent were carried out through the aid of governmental agencies.

Income Not Proportional to Increased Costs.

It is almost needless to state that the income of the companies did not keep pace with the increasing expenses. Those located in the centers of war activities experienced great demands for power, requiring in many cases greatly increased facilities which could be provided only at relatively enormous cost of construction as well as financing, and the situation was further complicated by the fact that much of the increased demand was of a temporary nature. Some central stations were compelled to operate their old equipment to a point where it was actually breaking down and it could be kept in service only at great expense. On the other hand, many of the smaller companies in rural sections experienced an actual loss in output due to temporary decrease in population. The introduction of the daylight-saving plan also very noticeably reduced the income of these companies. The continually decreasing quality and efficiency of all commodities including labor was a further source of expense and an increasing burden upon the shoulders of the management.

The result of these conditions was, of course, a progressive increase in the total expenses and it became necessary to employ various means to partially offset the continual decline in net revenues. In order to distribute the burden of increased costs of producing energy as equitably as possible and to minimize complications, rates to large consumers were adjusted first. A common expedient was the addition of a surcharge per kilowatt-hour varying in certain ratio with the price of coal and in some instances the quality of the coal was also made a determining factor. Many of the larger companies serving war-active territories were able to get along with the aid of these expedients. Others not so fortunately situated found it necessary to put into effect general increases which were in some cases in the nature of a percentage surcharge.

The accompanying diagram shows the relation of monthly income and expense per kilowatt-hour from 1916 to date for a small company operating in a rural community where there were no war activities. As a portion of its energy is obtained from water power, its situation is probably better than the average. It will be noted that the trend of the expense line is generally upward even now, and further that the rate increase was effective in reducing the sales to some extent.

Public Sentiment Not Unfavorable to Increases.

Public sentiment in general was not unfavorable to necessary rate increases and in some instances it was recorded as openly advocating a raise. The utility commissions properly took the position that the conditions were temporarily abnormal and granted temporary increases generally for a 6 or 12 months' period. The urgent necessity of relief as well as the multitude of cases demanding attention made it impossible for each case to receive the detailed investigation ordinarily conducted. In comparatively few cases was it deemed necessary to go deeply into the question of valuation. Valuations used in previous proceedings were used where available, supplemented by additions taken at their actual cost. The values thus found were, of course, much lower than the reproduction new, less depreciation values as of the present time. The usual five-year average values are also considerable above the pre-war or so-called "Normal Values" and were generally rejected by the commissions for

that reason. In a few cases, average prices over a ten-year period were used.

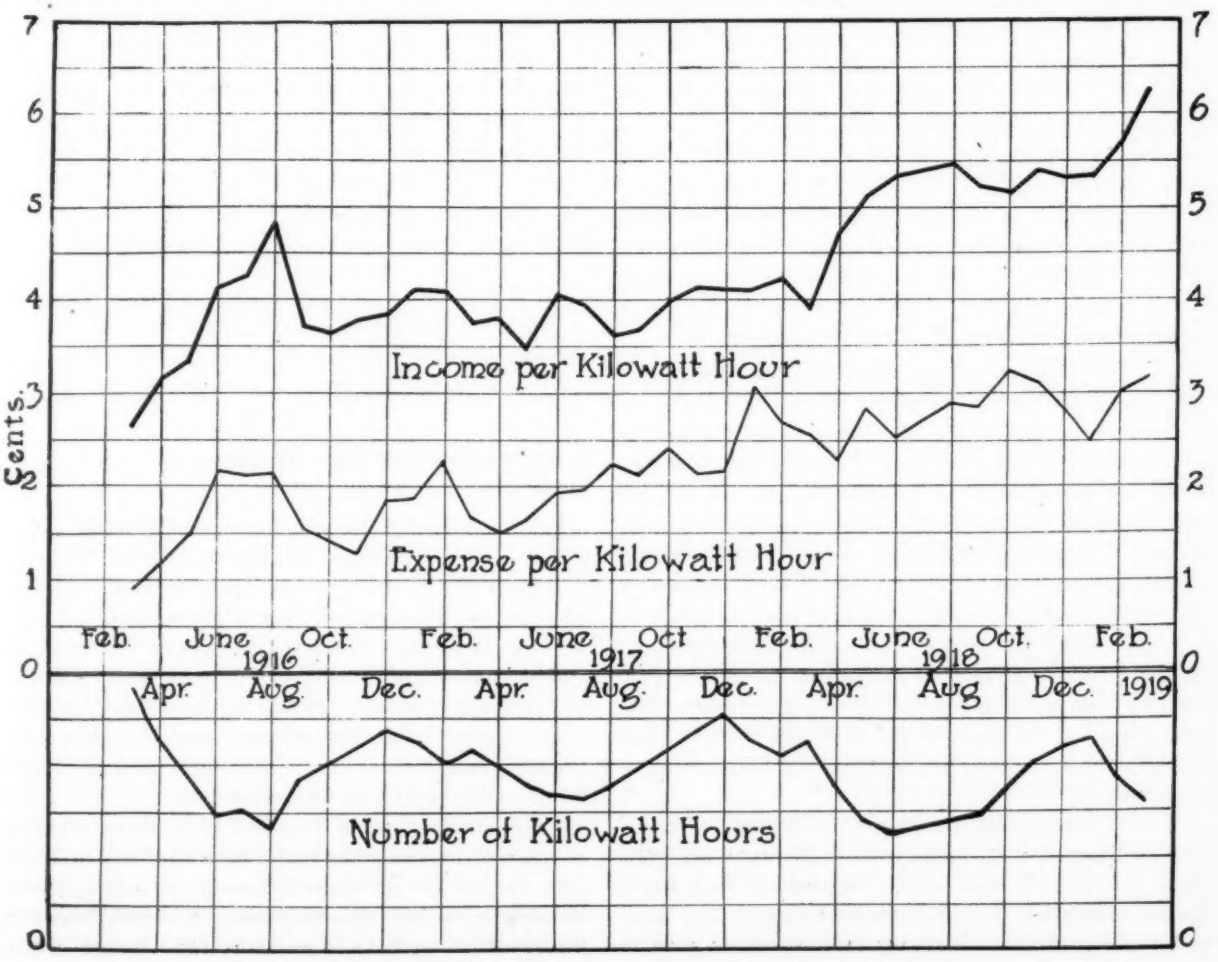
Generally speaking, where inventories of the property were not available, approximations were resorted to, and as the rates based thereon were of a temporary nature, no great injustice thereby resulted either to the utility or to the public. In general, the trend of rate-making value found is in line with the statement of one commission, viz.: "A public service company has no ground for complaint if, in a valuation for rate-making, average unit prices prior to the war are adopted and such war-time costs as were actually incurred are allowed in the appraisal." Such treatment of the situation has resulted in no great injustice to anyone concerned. As a consequence, the rate increases granted practically offset the increased expenses and put the companies approximately in as good condition as they were before the abnormal increases in operating costs took place.

It has, however, been held in at least one case that a prosperous utility was not entitled to a rate increase on a showing of increased expenses only. The trend of all findings has generally been that the utility should bear some of the war burden. While this policy may be equitable, it has sometimes resulted in embarrassment to the company when additional financing is required. The frequent renewal of temporary rates has been found to be a matter of considerable trouble and expense to the companies as well as burdensome to the commissions and should be eliminated as soon as possible.

The experience of the companies who increased rates has generally been that some actual loss of business has resulted, as would naturally be expected. In some instances, this loss, together with additional increases in expenses compelled the company to obtain further rate increases. The resulting situation became so serious, particularly in some very small companies, that they still could not operate under increased rates without loss and in at least one instance the company was permitted to abandon operation within six months unless taken over by the municipality and the deficit thus made good out of taxation. In this case it was found that a rate of 30 cents per kilowatt-hour would be required to meet operating expenses. It might be remarked in passing that this was not a part of a system under unified operation. Similar and more numerous cases existed of utilities other than electric companies.

Utility Market Broadening.

Although the situation of the utilities is not as satisfactory as in pre-war times the outlook for the industry today is far from pessimistic. Some material costs have decreased, and while labor shows no tendency to cheapen, the market is broadening. Slight improvement has been reflected in operating cost but it will naturally lag behind the commodity market as large stocks of coal and other supplies are yet on hand which were purchased or contracted far above the present market and these must be used up before the effect of the lower prices can be seen.



Relation of Monthly Income and Expense per Kilowatt-Hour for Small Company.

Editorial Comment

Industrial Trucks and Tractors

ONE of the papers to be presented at the National Electric Light convention will point out the opportunities for central stations in the industrial electric truck and tractor field. An article in this issue also deals with the subject in a comprehensive manner.

A tremendous amount of profitable business can be secured by the introduction of industrial haulage equipment in our factories. Manufacturers of trucks and tractors, storage batteries and charging equipment are ready to co-operate with central stations. Now is the time to give serious consideration to this subject.

The "Own Your Home" Movement

OWN YOUR HOME campaigns are being vigorously promoted in all sections of the country by the National Lumber Manufacturers' Association with which are affiliated nearly all prominent lumbermen's organizations. In connection with these campaigns these associations are doing considerable display advertising and are distributing attractive pamphlets to dealers, explaining the best methods of conducting such campaigns and to the public describing the advantages of owning your own home. Such campaigns, properly conducted, are real public betterment movements and, as such, should be encouraged and supported by the central-station companies and electrical contractors in every possible way.

Studying Utility Rates Problem

RATE problems are probably at all times the most vexatious ones of public utility companies in their dealings with the public. Just now they are peculiarly difficult. Those utilities that succeeded in having rates raised to provide the income needed to meet high operating costs are confronted with efforts to reduce the rates again even though operating costs have fallen but little, if at all. Those companies that have used previously gathered reserve funds to tide over what was hoped to be a temporary emergency are now making desperate efforts to secure rate advances in order to stave off receivership. The public is naturally eager to see all prices brought back to normal and strongly opposes attempts to raise them now.

Utility companies are therefore finding it necessary to proceed with peculiar care in preparing petitions for rate changes or in defending themselves against attempted slashes in existing rates. The large and wealthy utilities can engage rate experts to prepare and present their cases before public service commissions, but the small companies in many cases cannot do so because of limited resources. Especially by the smaller utilities, the entire problem of rates and the bases on which they are determined needs special study just now.

In this issue we present the first of a dozen articles by Mr. C. W. McKay on this very subject that should prove of great value to all electric utilities and particularly those that have not been able to give systematic study to the many angles of the rate problem. These articles will speak for themselves, but we urge that they be not only perused but preserved.

Domestic Electric Appliances

NEVER before in the history of the electrical industry has there been such activity in the field of domestic electrical appliances as exists today. Practically all manufacturers report that their plants are working to capacity and central stations and dealers are doing an unusually large volume of business.

The reasons for this condition are obvious. In the first place the electrical appliance has become a household necessity. Also, the serious shortage in domestic labor has greatly stimulated the use of labor-saving devices, as have the higher standards of living on the part of all classes of labor. Finally, central stations and dealers have made special effort to secure this class of business, especially since the restrictions were put into effect on practically all other business.

The saturation point is still far distant and efforts should be redoubled to increase the use of appliances under favorable conditions existing today.

Electricity for Ice Making

THE ARTICLE by Mr. Carlsen in this issue shows what an important and profitable load can be developed among ice plants. There is no longer any doubt regarding the purity and satisfactoriness of raw-water ice, nor is there doubt concerning the advantages from the standpoint of operation and economy of the motor-driven compressor plant.

Ice plants usually operate 24 hours per day and their peak is during the summer months, when additional central-station business is most desired. Hence they can be offered an attractive rate.

This summer, when there will be a serious shortage of natural ice, and when many breweries will undoubtedly engage in ice manufacturing, an effort should be made to secure this business. A careful study of the situation, such as is made by the Chicago central station, is necessary and should be undertaken at once.

National Electric Light Association Convention

THE forty-second convention of the National Electric Light Association, that convenes at Atlantic City next week, marks the parting of the ways, when the readjustment from war to peace is a fact, when the problems of war are put behind and the problems of peace are faced. While the period of readjustment is with us still, following the convention the central-station industry will have the benefit of a better understanding of conditions as they are in the industry itself and in the nation's industries. After the convention central-station companies will be fortified on a post-war basis and strengthened by the morale and the guidance of the National Electric Light Association.

The forty-second convention of the National Electric Light Association is pre-eminently a post-war convention. It will bring together all the lessons of the war to the central stations. It will be upon the findings and inspirations of this convention that the central-station industry will shape its course during the coming year. This convention is probably the most important event in the central-station field since the formation of the Association in 1885.

Every one of the forty-one conventions so far held has been of value. This year's convention will be no exception to the rule for many reasons. In fact, its immediate and ultimate value ought to exceed that of former conventions. To begin with, the convention is the first big one held for three years and, therefore, three years' developments and trends await recounting and interpretation for the future progress of the central-station industry. Secondly, these three years were unprecedentedly busy and difficult ones, the richest in attainment, since the National Electric Light Association came into being—since the central-station industry came into existence. Where previous conventions dealt with normal growth and conditions as they gradually developed, this, the forty-second convention, takes place at a time when world changes as well as domestic upheavals are under way. It is largely with the influences, the inferences and experiences of the last two strenuous years and their effect upon the future that the convention will deal.

Our problems here at home may not be as perplexing as those problems *internationale* concerning the birth of nations, the re-distribution of boundaries and the league of nations. But they are none the less real. More specifically, the National Electric Light Association, representing the great central-station industry that serves over 10,000 communities, has a capital exceeding four billion dollars and gives employment to 80,000 persons, is facing the many vital problems of the day. These problems are many and varied, financial, public policy, commercial and technical, and upon which the progress of central-station industry largely depends.

We all know in part at least the great work accomplished by the Committee on Gas and Electric Service toward shortening the war and thereby saving human life, reducing agony and suffering and conserving treasure. It is a tale worth telling. We know something of what the war taught, the lessons that were brought home to us, each in our own way—lessons of thrift, saving and economy, of co-operation and closer harmony among conflicting interests. But we do not know to what extent those lessons have been learned, to what extent the central-station industry will profit tomorrow by the experience of yesterday; whether the industry will lapse to old-time methods that were relinquished to win the war or whether it will retain them and improve them.

This year the work of organizing the convention has been crowded into a few months—in fact, since the armistice was signed, instead of the customary year. This has necessitated an immense amount of work for the various committees to whom high praise and full credit is due. The chief value of a convention is the interchange of ideas and thoughts that takes place between those having kindred problems to solve. Each year of the association has seen a feast of valuable data brought together in interpretable form to be discussed. Much of this is utilized later when members go back to their systems again, where they put into practice those things they have learned through intercourse with fellow members of the National Electric Light Association.

Where there is so much to be discussed, each of importance to some phase of the central-station industry, little can be said specifically of any one. At the convention will be included all the topics of interest to the central-station man, whether it be commercial or technical. For those that build up loads there is the electric furnace for melting steel and brass, there is the industrial truck and tractor, electric ice-making and refrigeration and industrial electrochemical processes—all of them loads that played some part in helping to win the war, and all of them can be successfully procured during times of peace. There is the timely subject of interconnection and interchange of energy between systems, the development of summer service and co-operation with the isolated plant for mutual gain. Of more technical matters there are the problems of increasing the rating of underground conductors; improving the reliability of turbogenerators and safeguarding them against fire; of relay protection; and standardization of apparatus and methods in its many and varied forms.

The central-station industry has gone forward, always. It is a vital factor in industrial existence; its welfare is closely interwoven into the fabric of national life. Whatever has been asked of it, it has been ready to give. It leads, not follows. In this great far-reaching central-station industry no more potent force is there than the National Electric Light Association. Upon this organization depends in no small

measure the extent to which the war's lessons will be retained, to be made permanent practices and capitalized for future gain.

The convention will unquestionably establish a new standard that will be difficult to surpass. Great credit is due the officers and committees for their work.

Gas and Electricity

IT IS time that the electric utilities began to give more attention and consideration to the value of gas. It is not a matter of comparing gas on a candlepower basis, heat unit basis, upon a safety basis, as a competitor of electricity. It is a matter of co-operation, of co-ordinating interests, of applying each to its effective field, which means ultimately to its most efficient use.

We look to the day when we will heat water for all purposes electrically, when we shall cook electrically and heat our homes and buildings electrically. We are convinced that to do these things electrically is to do them most conveniently, most plausibly, most picturesquely, most safely and with freedom from odors. But the time when these things shall be is not yet, although much has been done toward that end where water powers are properly developed. Meanwhile, electricity has its own field, and gas its own field, as economic conditions are today.

The production of electricity from coal is atrociously inefficient, thermally speaking, except in those comparatively few instances where electricity is a by-product of coal. From the viewpoint of the chemist, and those that have the true interests of coal conservation at heart, the combustion of coal in furnaces for steam making is also to be deprecated, because such a small percentage of the chemical energy is converted into used heat while the thousand or more products pass away unutilized. By carbonizing or distilling coal instead of burning it in the raw state, more heat can be utilized than is the case now, and many if not most of the by-products can be retrieved and used. Meanwhile large quantities of gas are available, and coke, the residue of distillation of coal, can be marketed for domestic and industrial use.

If the movement for the true conservation of coal is to come, it is inevitable that the consumption of gas and electricity must progress together, in closer co-operation and less in competition. If abatement of the smoke nuisance, and all it implies, in the way of financial loss, injury to health and unpleasantness, is to come it will be first through the increased use of gas and coke for heating domestically and industrially. And it will be found easier to bring this about in localities where electricity supply from steam plants has attained the highest standard of generation, transmission and utilization.

In the interests of conserving our coal, for the elimination of the smoke nuisance, in the assistance of our chemical industries, and lastly for the satisfaction that comes from the knowledge that our processes are scientifically sound and fundamentally sensible, we want to see gas and electricity being used together, the former to produce the latter. This means that coal must be carbonized instead of burned; that valuable residues will be put to use, and the gas evolved used for making the steam in the central sation and for heating purposes generally where coke is not used.

Because it is cheaper to waste coal than to save it by using it most scientifically for ultimate economy, coal is being wasted today. Perhaps before many years are spent, public opinion, our vision, or legislation will combine to encourage the carbonization of coal and its efficient use through the two God-given mediums of gas and electricity.

National Factory Lighting Campaign

INDUSTRIAL lighting made noteworthy advances during the war just at the time when its efficiency-stimulating characteristics came in handy to increase production and help materially to meet the nation's call for war supplies. Progressive lighting interests believe that the development achieved in this line should by all means be continued, if possible more aggressively than during the war. The favorable attention given to the subject by many manufacturers shows that any relaxing of effort in pushing industrial lighting would throw away splendid opportunities to achieve further advance. This matter is discussed on other pages in this issue and the relation of the central stations thereto pointed out.

Careful analysis of all the circumstances indicates that the time is propitious for a national campaign to promote further modernization and extension of factory lighting. The ELECTRICAL REVIEW urges that this be thoroughly considered by all the national organizations and other electrical agencies that have co-operated so effectively in other nation-wide electrical campaigns, such as "America's Electrical Week," "Wire Your Home Time" and the present "Electrify Your Home" movement. The Society for Electrical Development has been the conspicuous leader in these successful efforts; it has the organization and facilities for undertaking such co-operative and co-ordinated campaigns. Regardless of which organization actually sponsors the movement it should be undertaken and not later than the beginning of September, in order to permit ample time to install the lighting systems so that the shortening days may see immediate utilization of the modern, productive equipment.

In all industrial communities such a campaign is needed because, although considerable improvement has been made in factory lighting in recent years, there is still room for many times as much. In non-industrial communities the effort may well be directed to lighting improvement in residences, stores, schools, etc. Perhaps it may be well to have a general lighting campaign to counteract what remains of the lighting-curtailment ideas. The subject is at least worthy of careful consideration.

Week's Events

N. E. L. A. Birthplace to be Razed—New Westinghouse Scholarships—General Electric War Record—Other News

BIRTHPLACE OF N. E. L. A. IN CHICAGO TO BE RAZED.

Report Concerning Grand Pacific Hotel, Chicago, Recalls Origin of Association.

The recent report that the Grand Pacific hotel, in Chicago, is to be razed to give place to a large office building calls to mind the origin of the National Electric Light Association. It was in this hotel on Feb. 15, 1885, that William A. Hovey, then associate editor of the ELECTRICAL REVIEW, called the first meeting of the Association to order. The temporary officers were then named who were later succeeded by permanent officers named by the Committee on Permanent Organization. Mr. Hovey was elected secretary-treasurer and served in this capacity for the first six months. Shortly after the organization work was completed the attendants were welcomed by Mayor Carter Harrison who in eloquent terms predicted the great future of the electrical industry.

Probably the only attendant at the Atlantic City convention of the Association who was also present at the birth of the Association will be Charles W. Price, chairman of the Board of Directors of the International Trade Press, Inc., publisher of the ELECTRICAL REVIEW and several other prominent trade journals. Mr. Price was a member of the original Committee on Permanent Organization and has taken an active part in the work of the Association since that time.

WESTINGHOUSE COMPANY ESTABLISHES MEMORIAL SCHOLARSHIPS.

To Commemorate War Service—Four Years' Technical Training Provided for Sons of Employes.

As a proper war memorial to the more than 8000 employes of the Westinghouse Electric & Manufacturing Co. who entered the service of the Government in the great war, the company has decided to establish a number of technical scholarships. The details of the plan by which this will be done have been given out by President E. M. Herr as follows:

"Four war memorial scholarships will be established each year under the following general conditions:

"(a) Candidates will be limited to sons of employes of the Westinghouse Electric & Manufacturing Co. and its subsidiaries, who shall have been employes in good standing for a period of five years.

"(b) Two of such annual scholarships may be open to the younger employes of the company or its subsidiaries who have been in the service for a period of at least two years and who do not exceed the age of 23.

"(c) The selection is to be determined by competitive examination to be conducted annually by the company's educational department under the direction of the committee hereinafter provided. The examination is to take into account not only the applicant's academic training and preparedness, but due consideration will be given to personal qualifications, general character and aptitude.

"(d) Scholarships will entitle the successful candidate to pursue a four years' course in any technical school or college that he may select with the approval of the committee. The scholar may pursue a course in any branch of engineering that he may select.

"(e) Scholarships will be granted for one year only, but will be continued for the full four years provided the scholar maintains the academic and other standards required by the college or institution in which he elects to pursue his course of study.

"(f) Each scholarship carries with it an annual payment of $500, to be made in two installments, and the number of new scholarships will be four each year.

"(g) The company will establish a Memorial Scholarship Committee consisting of three vice-presidents of the company to whom shall be referred the names and records of the candidates and who will select therefrom the four successful persons who in its judgment have most satisfactorily met the tests applied. The said committee will also be charged with the duty of establishing the detailed rules and regulations and such other matters of administration as have to do with this particular matter.

"It is the intention of the company to continue these memorial scholarships from year to year, but the company reserves the right to recognize changing conditions and to modify the plan or discontinue it entirely, if in its judgment it seems wise and expedient to do so."

NATIONAL CONFERENCE ENDORSES PERMANENT PUBLIC EMPLOYMENT SYSTEM.

Legislative Committee Appointed to Draft Measure to Be Presented to Congress.

Representatives of the Governors of the states called by Secretary of Labor Wilson for a three-day conference in Washington, D. C., to discuss the question of employment voted unanimously in favor of the establishment of a permanent public employment system for the United States and agreed upon the principles of a bill, which after being put into shape by a legislative committee, will be submitted to the 66th Congress as a measure having the endorsement of all interested in the employment question. Representatives of the United States Employment Service and of employers and workers also attended the conference.

The measure agreed upon calls for the continuance of the United States Employment Service, now existing as a war emergency organization, as a permanent bureau in the Department of Labor and for a system of state employment offices in co-operation with the United States Employment Service, working with

contributions of federal funds and under standards, rules and regulations prescribed by the United States Employment Service, which also will handle labor clearances between states, inspection and gathering of information as to labor conditions.

Secretary of Labor Wilson in addressing the conference denied charges that the Department of Labor and the United States Employment Service favored unionism and gave preference to union members over non-union workers applying to the offices of the United States Employment Service. He also said that the private fee-charging agency system was one of the most potent factors contributing to the great labor turnover in this country. Both the Secretary and John B. Densmore, director general of the United States Employment Service, emphasized the point that the Federal Employment Service had no desire to monopolize the public employment field or subordinate state services. On the contrary, they said, the Federal Employment Service should assist states in organizing and maintaining state services. "To my mind," Mr. Wilson said, "the most efficient organization that can be constructed and is the most likely to be permanent is one that includes federal, state and municipal employment agencies."

Following are the members of the legislative committee appointed by the conference to draft the measure for a permanent public employment system which will be submitted to Congress: Dr. George W. Kirchwey, New York, Federal director of the United States Employment Service for New York state, chairman; Charles F. Gettemy, state commissioner of labor, Boston, Mass.; C. R. Keilly, executive secretary, Virginia State Council of Defense, Richmond; C. H. Mayhugh, formerly of the Ohio State Industrial Commission and associate Federal director of the United States Employment Service in Ohio; Prof. F. S. Deibler, General Labor Advisory Board for Illinois, Chicago.

ELECTRIFICATION OF BELGIAN RAILWAYS.

Commission Recently Appointed to Consider Question and Submit Proposals.

A recent decree provides for the appointment of a commission to examine the question of the electrification of Belgian railways, and to submit proposals for the execution of the scheme.

Before the armistice a commission sat at Havre on the question of electrification of the railways. The work of this commission was understood to be in an advanced stage last January, and a further conference was held towards the end of February to decide definitely whether or not any Belgian lines would be electrified.

The projected scheme is to electrify main trunk lines on the overhead trolley system. New carriages and motors would be supplied for the purpose, but trains would be so constructed as to be suitable for steam haulage over non-electrified lines. Carriages would be of the "coupé vent" bogey, metropolitan type, interconnecting, and would have two doors on either side. The object aimed at would be to use trains over scheduled distances, i. e., trains would run backwards and forwards on such routes as Antwerp-Brussels, or Arlon-Ostend. Auxiliary lines might be electrified later. The idea is to use German railway materials pending the replacement of this by new rolling stock.

WESTINGHOUSE AGENT-JOBBERS ELECT NEW OFFICERS AT ANNUAL CONVENTION.

F. E. Stowe of Philadelphia, Elected President for Coming Year—Other Officers.

The Westinghouse Agent-Jobbers' Association held its seventh annual meeting at Hotel Del Monte, Del Monte, Cal., May 5 to 9. The following officers have been elected for the ensuing year: President, F. E. Stowe, secretary-treasurer of the H. C. Roberts Electrical Supply Co., Philadelphia, Pa.; vice-president, S. L. Nicholson, assistant to vice-president of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; secretary, C. C. Blackwell, manager electrical department, Moore-Handley Hardware Co., Birmingham, Ala.; assistant secretary, H. T. Pritchard, Westinghouse Electric & Manufacturing Co.; treasurer, J. E. McClernon, president of Northwestern Electric Equipment Co., New York, N. Y.

The newly-elected executive committee includes J. C. Schmidtbauer, vice-president of the Julius Andrae & Sons Co., Milwaukee, Wis.; Samuel Adams Chase, special representative, Westinghouse Electric & Manufacturing Co., East Pittsburgh; John J. Gibson, manager Supply Department, Westinghouse Electric & Manufacturing Co., East Pittsburgh.

SUBMARINE DETECTION BY WIRELESS.

Brief Description of Equipment and Methods Used by British in This Work.

An interesting account was recently given in London *Times* of the part played by flying boats stationed at Harwich in the detection and destruction of enemy submarines. It was at Harwich that the hydrophone for detecting submerged submarines was evolved. Flying boats were, of course, fitted with wireless equipment, and it was by this means that the presence of enemy submarines was revealed. When reporting to Germany by wireless the signals were picked up by two widely separated direction-finding stations in England, which each obtained a bearing of the submarine. The base line between the two English stations was known, and when the two bearings were plotted out, a triangle was formed, and the apex, where the two bearings crossed, gave the exact position of the U-boat. But the submarine took few chances in sending these signals. The two jumping wires which ran from end to end of the boat, passing over the conning tower, and forming a protection against nets, hawsers, and mines, were fitted as an auxiliary aerial, and therefore the submarine could wireless without setting up an aerial mast, and was in trim to dive immediately if any danger threatened. The Zeppelin patrols were carried out on orders direct from the Admiralty, the position, course, and speed of the aircraft being determined by wireless fixed in the same way as the submarines were spotted. Besides this work the flying boats carried out long reconnaissances from lighters, which could be towed behind destroyers. In order to keep the engines of the flying boats dry and warm, special padded covers were made and electric heaters fitted. The heating current was supplied from the destroyers to the lighters through waterproof cables. In the same manner electric heating was provided in the cramped cabins in the bows of the lighters which afforded a comfortable resting place for the crews.

GENERAL ELECTRIC WAR SERVICE RECORD.

Large Display Board on Works Avenue in Schenectady Plant Shows Enviable Record of Employes in Various War-Time Activities.

The enviable war record of General Electric Co. employes at the Schenectady works was summarized on a large display board located at the head of Works avenue, Schenectady, N. Y., to stimulate interest in the Victory loan.

In effect, this display board is a large and handsome poster showing the complete war work of the Schenectady employes in the Liberty Loan drives, the various fund campaigns and a record of local G. E. men in the army and navy service.

Surmounted by the American eagle and the motto "The U. S. A. Our Country," this board shows the number of bonds sold at all the loan drives, including the record for the Victory Loan. It gives the amounts raised for other campaigns, including War Savings Stamps. The total loans amount to $8,791,250 and the total war gifts $339,313. The work's honor roll

Attractive Display Bulletin of War Record of Schenectady Works, General Electric Co.

contains 3278 names and there are 35 gold stars on the work's honor flag.

This bulletin board is in colors, with the emblem of various war relief organizations on either side, and is really a wonderful piece of work.

BRITISH WIRELESS AND AIRCRAFT IN THE WAR.

Use of Wireless in Military Operations Shown in Synopsis of British Effort.

The British official "Synopsis of British Air Effort During the War" published in London on April 23 contained the following section relating to "Artillery Co-operation and Wireless":

"It was realized from the first that one of the most important duties of the airplane would be co-operation with the artillery, and various methods of communication between machines and batteries or ships were devised. At first signals were passed by evolutions of the machine over the target and later by signal lamps or smoke balls fired from Véry pistols. These, however, involved great delay and trouble in returning from target to battery, as signals were only visible at close range. At the outbreak of war the use of wireless telegraphy in connection with aircraft was in its infancy; a certain amount of experimental work had been carried out but no standard types of apparatus had been adopted. Only one of the machines which left with the original expeditionary force was fitted with wireless apparatus, which was not employed until some stable condition was reached on the Aisne, when work in conjunction with the artillery was started. From this time onward wireless grew very rapidly and every battery was gradually equipped with a wireless receiving station; at the end of 1916 there were about 2000 Air Service wireless operators and mechanics and by the end of 1917 this number had increased to approximately 3760. The earliest experiments in wireless telephony were carried out between Farnborough and Brooklands, but it was not until 1917 that anything like an efficient set was designed and demonstrated in the air. About this time night-bombing machines in France (F. E. 2 b's) were fitted with C. W. transmitters, and this means of communication, which had a range of about 75 miles, proved of great value in reporting lighted enemy airdromes and other suitable targets. At the present time there are about 80 C. W. wireless stations maintained by the Royal Air Force in France alone, providing communications between various units in the field. There are also several hundred battery stations. To meet the steadily increasing demands for trained officers and operators, a training school was started in 1916 with about 30 officer pupils and 500 other ranks. This school has now 152 officers and 2400 other ranks under instruction. The wireless branch now consists of approximately 520 officers and 6200 other ranks."

EIGHT-HOUR DAY FOR POSTAL TELEGRAPHERS.

Threatening Strike Averted by Recent Action of Government Authorities.

Charles P. Bruch, Federal manager of the Postal Telegraph system, has announced that effective June 1, the eight-hour day and time-and-a-half for overtime had been adopted for all its employes in 51 large and small cities in the United States.

Mr. Bruch said that not all the details of the change in working conditions, which had been approved by Postmaster-General Burleson, had been worked out, but that the preliminary order stated that the shorter workday would apply to "all employes in Postal offices working under similar conditions or doing work corresponding to that of employes in the service of other telegraph companies in the 51 cities."

EFFICIENCY OF RADIO AMPLIFIERS DISCUSSED.

The New York Section of the Institute of Radio Engineers met on Wednesday, May 7. The program consisted of a paper entitled "Detecting the Efficiency of a Thermionic Amplifier," by Dr. H. J. Van der Bijl, of the Western Electric Co., and an interesting discussion of the paper by several radio engineers and physicists. Among those who engaged in the discussion were John H. Mills, Stuart Ballantyne, E. F. W. Alexanderson, Dr. Alfred N. Goldsmith and D. J. M. Miller of the United States Bureau of Standards.

Commercial Practice

Data on Electric Furnace Performance for Melting Metals with High Zinc Content — Comparative Operating Costs

ELECTRIC FURNACE PERFORMANCE FOR ALLOYS WITH HIGH ZINC CONTENT.

Commercial Data as to Energy Consumption and Metal Losses in Industrial Installations.

The electric furnace and the central station industry has become almost a slogan. The central stations, at least the larger ones, now appreciate the value of the electric furnace as a load builder, and have gone after this type of load enthusiastically and wholeheartedly. Many of the less progressive and smaller companies are now following suit, with the result that the utilities are beginning to encourage the electric furnace load to come to their lines. The foundry and the mill have also taken rapidly to the electric furnace for reasons of their own, higher grade product, increased rates of production and lower unit cost.

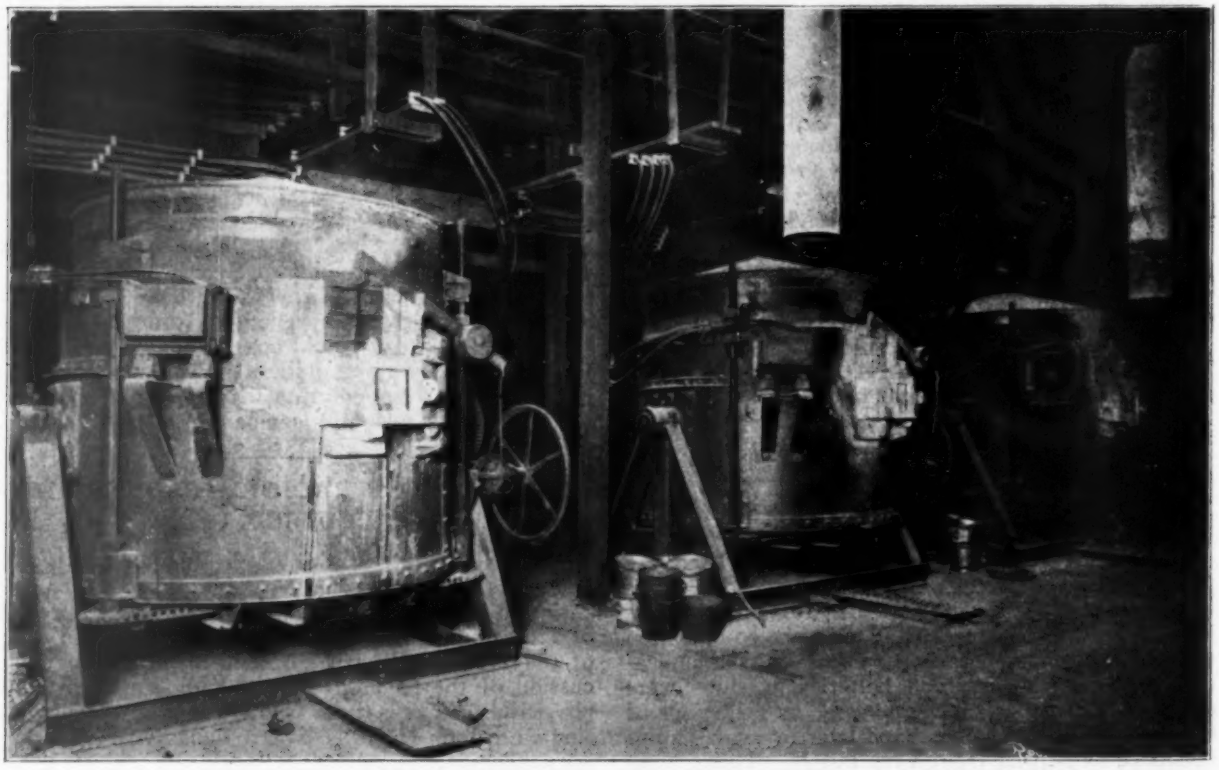
The power engineer of the central station company in attempting to interest prospective power users in the electric furnace must be able to compare the performance of the electric furnace with that of the gas, coke and oil furnace for the same work. He must be able to capitalize one or more features of the electric furnace to make it worth while, or convince the foundry already using types of furnace other than the electric that they must go over to doing things electrically.

In the following some interesting, and at the same time valuable data is given as to the performance of the electric furnaces for melting alloys containing a high percentage of zinc. The performance was obtained in Baily furnaces, to the manufacturer of which we are indebted for this class of information usually so difficult to obtain.

Reduction in Zinc Losses.

One of the great problems facing the brass foundry in the past, especially during the war when the price of zinc soared many hundred per cent above pre-war prices, has been to reduce the loss of zinc in the making of brass and other alloys using large quantities of zinc. So far the only way to reduce these zinc losses, zinc is so volatile a metal that difficulty is experienced in obtaining uniform qualities of brass castings in the oil, gas or coke furnaces, has been the electric furnace. That this type of furnace solves the problem is shown by the accompanying performance obtained by electric furnace operating over a lengthy period during which careful records of zinc losses were kept.

The above records are typical of a week's performance of a Baily furnace. The losses of the electric furnace, namely 1.3% for 14 tons of yellow brass, should be contrasted with the loss of between 3 and



Three of the Four Electric Furnaces at Standard Sanitary Mfg. Co.'s Plant, Louisville, Ky.

6% that occurs with the fuel-fired furnaces. It might be pointed out that the above loss of 1.3% was smaller than the guarantee which was that the loss should not exceed 1.5% on yellow scrap brass and 1% on rolling mill brass.

That the metal losses shown were not exceptional is best emphasized by the following data obtained over

TEST OF METAL LOSS MADE AT STANDARD SANITARY MFG. CO., LOUISVILLE, KY.

Date	Kind of material	Weight charged	Weight poured	Loss lb.	Loss pct.	Av. voltage
July 8—	Yellow brass scrap	3,000	2,950	50	1.6	85
July 9—	Yellow brass scrap	5,000	4,748½	251½	5.0	84
July 10—	Yellow brass scrap	6,020	5,835	185	3.0	83
July 11—	Yellow brass scrap	6,000	5,943½	56½	.94	84
July 12—	Yellow brass scrap	5,900	5,932	32*	.54	84
July 13—	Yellow brass scrap	2,400	2,532	132	5.5	83

Total metal charged for 6 day run.....28,320 lb.
Total metal poured for 6 day run.....27,941 lb.
Total metal loss for 6 day run..... 379 lb.
Pct. metal loss for 6 day run..... 1.3%
*Gain.

a six-week period. Moreover, the Standard Sanitary Mfg. Co. are now installing their fourth furnace because of the good results obtained with the first and later ones.

Total melt for six weeks.....181,304 lb.
Total poured for six weeks.....179,833 lb.
Loss in melt..... 1,471 lb. or .8113% melt loss for 6 weeks

The following results were obtained by an electric furnace with a rated capacity of 200 tons of zinc cathode per day. This furnace is installed at the Great Falls (Montana) plant of the American Copper Mining Co.

PERFORMANCE OF 1000-KW. ZINC CATHODE MELTING FURNACE. TEST WEEK OF JAN. 27, 1919.

Date	Kind of material	Weight charged	Weight poured	Dross lb.	Dross pct.	Kw-hr. used	Kw-hr. per ton charged
Jan. 27—	Zinc Cathode	279,240	270,369	8,871	.03	10,800	77
Jan. 28—	Zinc Cathode	255,430	247,119	8,311	.03	9,000	70
Jan. 29—	Zinc Cathode	257,410	250,163	7,247	.028	9,000	70
Jan. 30—	Zinc Cathode	323,500	320,746	2,754	.008	12,960	80

Total metal charged.....1,115,580 lb.
Total metal poured.....1,088,397 lb.
Total metal dross..... 27,183 lb.
Pct. of metal dross..... .024%

The savings of a few weeks were great enough to more than pay the total cost of the entire electric-melting equipment.

COMPARATIVE MELTING COSTS.

In endeavoring to interest foundries in the electric furnace where oil or coke furnaces are already installed, it is necessary to be able to compare the relative melting costs of the different types of furnaces. The accompanying table is of interest in this connection.

MELTING BRASS CONTAINING 65% COPPER AND 35% ZINC.

	Coke-fired crucible pit	Open-flame oil	Electric
1,200 lb. coke @ $9.00 ton	$ 5.40	.....	.....
50 gal. oil @ 8c	.....	$ 4.00	.....
400 kw-hr. @ 1½c	....	.....	$ 6.00
3% metal loss—60 lb. zinc @ 10c	6.00	.....	.....
5% metal loss—100 lb. zinc @ 10c	.....	10.00	.....
1% metal loss—20 lb. zinc @ 10c	.....	.....	2.00
Crucible cost, per ton of melt	8.00	.....	.....
Renewals and repairs to furnace	.10	.50	.50
Total per ton of melt	$19.50	$14.50	$ 8.50

The above comparison is based on the following figures:

	Coke	Oil	Electricity
Fuel price	$9.00 per ton	8c per gal.	1½c per kw-hr.
Fuel quantity, per ton	1,200 lb.	50 gal.	400 kw-hr.
Metal loss	3%	5%	1%

Zinc value 10c per lb.

No. 80 Crucibles—16c per number (average life 15 200-lb. heats).

MELTING PHOSPHOR BRONZE ELECTRICALLY.

A 105-kw. electric furnace installed at the automobile works of the Buick Motor Co. at Flint, Mich., has enabled data to be obtained on the time and energy required for melting phosphor bronze in the electric furnace. The performance of this furnace is given in the accompanying table:

Total charge for 9 hours.....6,033 lb.
Total poured for 9 hours.....5,991½ lb.
Total loss..... 41½ lb.
Pct. loss..... 0.68%
Total kw-hr. used..... 907
Total kw-hr. per ton charged..... 306

Percentage of metal loss less than 1%. Power consumption per ton, almost 100 kw-hr. under guaranteed figures.

The above current consumption is based on continuous 24-hour operation. Twenty-five per cent additional electrical current is required for heating up each day, if the furnace is run on a 10-hour schedule.

DATA ON PERFORMANCE OF PHOSPHOR BRONZE MELTING FURNACE AT BUICK MOTOR CO., FLINT, MICH.

Start	Time End	Heat	Weight charged	Weight poured	Loss pct.	Roof temp.	Bath temp.	Kw-hr. used	Kw-hr. per ton charged
6:30	8:50	2 Hrs., 20 Min.	1,516	1,498	1.1%	2,200 2,300	1,900	246	324
9:15	11:15	2 Hrs.	1,509	1,518½	9½*	2,260 2,340	1,960	252	332
11:45	1:20	1 Hr., 35 Min.	1,505	1,485	1.3%	2,360 2,380	2,000	203	268
1:50	3:20	1 Hr., 30 Min.	1,503	1,490	.8%	2,300 2,350	2,000	206	272

*Gain

Operating Practice

Interesting Features of Cleveland Electric Illuminating Co.'s Industrial Substations — Condenser Tube Corrosion

SALIENT FEATURES OF CLEVELAND INDUSTRIAL SUBSTATIONS.

Cleveland Electric Illuminating Co. Follows Interesting Practices.

The industrial substation has come to mean an installation of transformers, measuring instruments, sectionalizing apparatus, etc., that is installed upon or in close proximity to the customer served. These substations are often operated without attendants and are often closed to access on the part of anyone except the central-station company owning or operating it. These industrial substations may vary from wooden-frame corruguated-iron structures to fireproof buildings of concrete or brick, depending upon the company using them, environment and the apparatus housed, or may be of the outdoor type.

The Cleveland Electric Illuminating Co. has built a number of industrial substations that possess many interesting features which may be taken as an example for other companies to follow. Fig. 1 shows the external view of one of this company's industrial substations. This substation, on the customer's premises, is of masonry and contains five 400-kw., three-phase, oil-cooled transformers stepping down the voltage from 11,430 to 480 volts, with space for a sixth unit. Energy is supplied over two No. 4/0 three-conductor

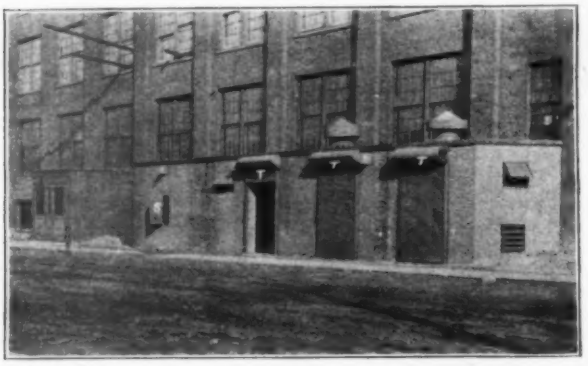


Fig. 1.

cables through interlocked oil circuit-breakers. All metering is accomplished on the 11,430-volt side.

Figs. 2 and 3 show the external view and diagrammatic layout of another typical substation containing three 500-kw. single-phase self-cooled oil-immersed transformers connected high-tension in star and low-tension in delta, for transforming from 6600 to 2300 volts. Oil circuit-breakers are here in duplicate and supply is furnished over No. 4/0 11,000-volt underground conductors.

Referring to the reference letters on the external views and the diagrammatic sketch of the internal layout, it will be seen that these substations embrace several unusual and laudable features. Entrance to the high-voltage compartment can be obtained only through entrances *T*, through which the transformers and other apparatus may be moved. Any transformer can be taken out or in without disturbing any other unit. The door marked *S* is to permit the customer to operate the circuit-breakers on the 11,000-volt cable

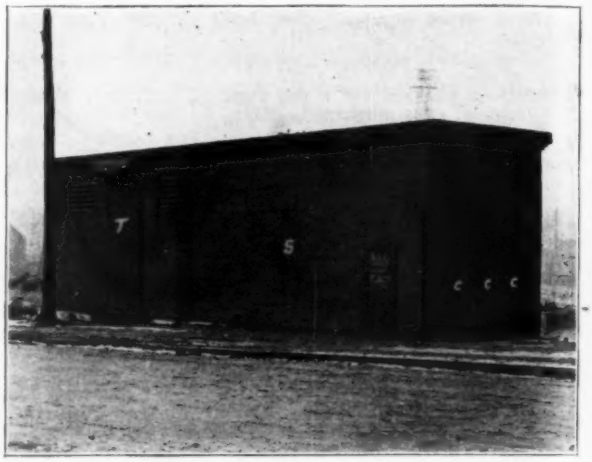


Fig. 2.

supplying the transformers without entering the company's station. In this way the customer can protect himself and cut off supply quickly in emergency without endangering anyone or opening up the possibility of mistakes. The doors marked *T* and *S* are both steel-rolling doors. The openings marked *C*, Fig. 2, are to permit the customer operating the 2300-volt

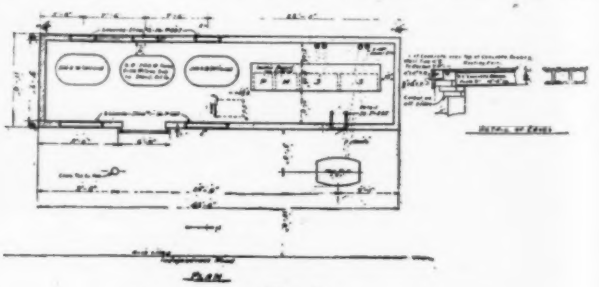


Fig. 3.

switches without gaining access to the substation, there being one door for each transformer bank.

Special attention is drawn to the methods of ventilation—one of the most vexacious matters connected with installing large self-cooled transformers in cramped locations. The way in which circulation of air is accomplished is different in the two substations shown. It will also be seen that sufficient daylight enters the structures to permit work to be done during the day without artificial light—a wise measure where it may be necessary to work while energy is cut off.

SOME PRACTICAL OBSERVATIONS ON CORROSION OF CONDENSER TUBES.

Abstracts of Corrosion Committee's Report, Institute of Metals.

Most central stations have some time or other experienced trouble due to corrosion of condenser tubes. The best talent of many countries has tackled the subject with little result so far as eliminating or explaining corrosion.

Parts II and III of the Institute of Metals' Corrosion Committee Report contains pertinent statements regarding the corrosion of condenser tubes. The accompanying table shows what are considered to be the chief causes of corrosion on the water side of condenser tubes and ferrules, explaining the nature of action, how produced and the probable remedy. According to this report, local corrosion in condenser tubes may be started initially by the action of certain bodies, which themselves appear to take no direct part in the action. Such bodies are sand, calcium carbonate, ferric hydrate, glass, clinker and coke. The amount of action that takes place varies with the physical properties of the substance. The action is associated with the accumulation of products of corrosion and may be largely assisted by them. The nature of this action is of well-marked type and has been provisionally called oxide disintegration. It is usually characterized by intercrystalline oxidation. Actions of this kind are of great importance in many cases of corrosion on the practical scale.

In practice factors set out separately in the table may act jointly. Causes of corrosion are not arranged in the table in order of importance, since this order varies in different types of installation. The effect of water speed on the rate of corrosion varies with the type of corrosion. The effect of the presence of a scale on the rate of corrosion is considered to be of great importance. Of the substances that commonly occur in scale calcium carbonate is one of the most important. Its effect varies with its physical condition. It may exert almost any kind of effect from a considerable degree of protection to a serious attack.

It is found in practice tubes fail sooner than the period stated, because the normal slow roughening of the tube by chemical oxidation is locally speeded up by factors which are for the most part independent of the tube.

The first action of corrosion is one of chemical oxidation, and secondary actions are of great importance. No one single remedy is likely to be found effective for all the different kinds of attack which occur in practice. The nature of the tube used and the protective measures chosen should be dependent on the particular set of conditions.

The following is a set of conditions under which a 70/30 brass condenser tube should have a minimum life of 20 years:

(a) Only clear water to enter the tube, or water which will not deposit suspended matter.

(b) The water must be free from gases in suspension and must not contain more than the normal amount of air in solution.

(c) The water must be neutral or not more than very slightly alkaline. It must be free from ammonia and certain other specially harmful substances, which are, however, of comparatively rare occurrence in technical waters.

(d) The temperature of the cooling water in the hottest part of the condenser should not exceed 35° C.

(e) The speed of the water should be about 5 or 6 ft. per second.

(f) The steam should be properly distributed in the condenser, according to the best modern practice.

CAUSES OF CONDENSER TUBE AND FERRULE CORROSION (WATER SIDE ONLY CONSIDERED.)

Cause.	How produced.	Nature of action.	How to be remedied.
A. Foreign bodies carried in and accumulation of products.	A1. By ferric hydrate flakes from water ends. A2. By ashes, clinkers, etc. A3. By sludge of sorts in water supply.	Complete corrosion of the oxide disintegration type, causing local action.	A1. Paint the pipe line and water ends. Increase water speed. A1, A2 and A3. If worth while trap the water supply or pass it through a screen. In some cases increase water speed.
B. Acid or other bad or variable water supply.	B1. Some river supplies. B2. Some canal supplies, *e. g.*, ship canal. B3. Some well supplies. B4. Some estuarine supplies. B5. Some cooling tower arrangements.	Complete corrosion and rapid general thinning. Sometimes slight uniform dezincification.	Keep water supply slightly alkaline. Use special tubes adapted to the special conditions.
C. Temperature in condenser too high.	C1. Hot inlet water, *e. g.*, tropical. C2. Slow water speed. C3. Partial blocking of tubes.	C1. Dezincification. C2. Dezincification. C3. See A3.	C1 and C2. Use special tubes. C2. Increase speed. C3. See A3.
D. Undue aeration.	D1. Errors in pump and pipe line arrangements. D2. Eddies near inlet causing water-line effect.	D1. Complete corrosion of oxide disintegration type. D2. Complete corrosion of pitted areas.	D1. Remedy air leaks, etc. D2. Special ferrules. Possibly increasing speed of water with modified design of water end.
E. Unsuitable composition of tube.	E1. Zinc or impurities in too great amount. E2. Surface of tube not sufficiently copper-rich.	E1. Varies. E2. Dezincification.	E1. In manufacturing. E2. Probably by attention to details of annealing and pickling during manufacture.
F. Defective packing of tubes.	F1. Leaks caused by perishing of the packing material, especially in acid water. F2. Collapsing of tube.	F1. Varies. F2. Varies.	F1. Use good tape packing. Red lead is sometimes useful to prevent leakage. F2. Do not crush tube when inserting it.
G. Physically bad surface of tube; *e g.*, bad spills and laminations.	G1. Foreign bodies caught and trapped which would otherwise be swept away.	G1. Complete corrosion and oxide disintegration.	G1. During manufacture.
H. Thermo-electric action in condenser.	H. By steam impinging directly on tubes or being improperly distributed.	H. Dezincification.	H1. Only occurs in condensers of old design when steam is not properly distributed.
I. Too slow water speed.	I. Gases given off inside tube and not immediately swept away.	I. Complete corrosion near inlet end.	I. Increase speed of water. Do not use main condenser for auxiliary machinery import.

Contracting-Construction

Time and Money-Saving Devices for the Maintenance Man — Essential Features of House-Wiring Contract Forms

HANDY TOOLS FOR THE MAINTENANCE MAN.

Time and Money-Saving Devices Which Can Be Constructed Very Easily.

By James A. Perry.

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This is the first of a series of four articles describing the uses and construction of a number of handy tools for use by electricians. Although some of these descriptions have appeared in previous issues of the Electrical Review *and other journals, they are compiled in this series with others in a very convenient form which adds greatly to their value and for reference purposes.*

Manufacturers' catalogs contain splendid descriptions of the many regularly-manufactured tools that the electrical worker uses, hence no effort will be made to repeat the description of these. It is, however, the intention to discuss a number of devices that have been found very useful in practical electrical work and each can, for the most part, be readily made by the electrician from materials always available. Most of the devices are time and money savers.

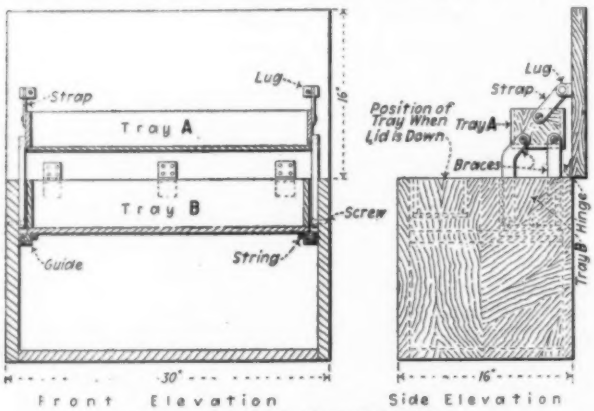
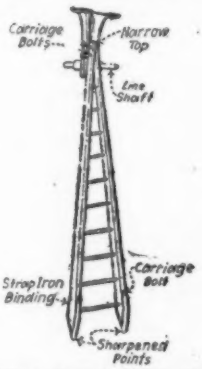
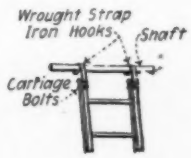


Fig. 1.—A Convenient Tool Box.

First of all, any mechanic should have a convenient serviceable chest in which to store his tools. That shown in Fig. 1 has given excellent service in a number of cases. Its construction is sturdy enough that it will successfully withstand the hard knocks to which an electrician's chest is subjected. The design shown was, we believe, first introduced by C. C. Payton of the Republic Iron & Steel Co., Sayreton, Ala. The heavy tools are placed in the bottom of the chest while the lighter ones are carried in two trays. One of these trays is attached to the cover of the chest by a series of strap-iron links. The arrangement, obvious from Fig. 1, is such that when the cover is open this tray *A* is drawn up with the cover. The other tray *B* slides in the usual way on 1 in. by 1 in. guides, while two ½-in. strings maintain it in alinement. When the top is open, both trays *A* and *B* and the tools in the bottom of the chest are at once accessible.

To prevent loss, all tools should be marked with the owner's initials. The marking should be such that it cannot be readily obliterated. A permanent mark can be made on steel tools by the following process





Figs. 2 and 3.—A Convenient Ladder for the Motor Tender. Safety Hooks for Ladders.

with materials that are nearly always at hand. First, the surface of the metal to be marked is covered with a thin coat of paraffin, or drippings from a tallow candle, painted on hot with a brush or rubbed on with the end of a stick. If paraffin or candle is not available, a coating of soap can be substituted. The soap is transferred to the surface by rubbing the end of a cake against it. With some tool that has a flat point somewhat like a screw-driver, except that it should be only 1/16 in. wide, the owner's initials are engraved through the soap or paraffin, cutting down to the surface of the metal. Now the etching solution can be applied with a small stick of wood. The etching solution is made as follows: One part of table salt (by bulk) is mixed with approximately two parts of powdered copper sulphate or blue vitriol, and the two are dissolved in about ¼ in. of water in the bottom of an ordinary tumbler. After the solution has been applied it will etch the design in the metal to a sufficient depth in a few minutes. Then the tool can be washed to remove all traces of the solution and the paraffin or soap.

Wiremen should provide themselves with safe ladders. Many designs are in use that afford the safety required. Only a few of these designs which have been given a thorough tryout will be described. The one shown in Fig. 2 is particularly useful around shafting, although it is also handy for work in the neighborhood of steel columns and where the ladder must be leaned against the stiles or rails of a window. As the illustration indicates, the narrow top permits the ladder to be firmly sustained by a shaft hanger or other similar member upon which it would be difficult to support a ladder of the ordinary type. The lower ends of the two rails of the ladder are shod with strap iron bindings which have pointed ends. This will prevent slipping on wood floors.

Where the ladder is to be used on concrete or metal

floors, a shoe of one of the types suggested in Fig. 4 should be used. That at Fig. 4 *A* is supported on a pivot, and has a corrugated bottom, hence the shoe always lies normal to the floor. A shoe having pointed spikes extending from its bottom is shown in Fig. 4, *B*. This type is used where the floors are of wood. A shoe with a wood center which will provide considerable friction and hence tend to prevent slipping even on concrete or iron, is shown at *C*. Where wood—

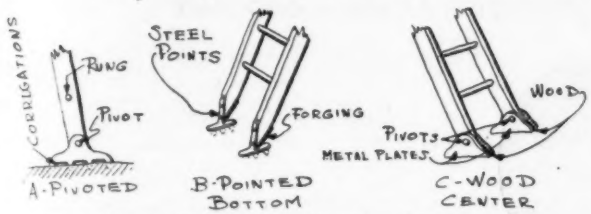


Fig. 4.—Shoes for Motor Tender and Wireman's Ladder.

bass wood is the best—does not give sufficient friction, the center member of the shoe shown at *C* can be coated with carborundum or lead, which will greatly increase its adhesiveness. Where ladders without narrow tops are in stock and must be used around shafting, strap iron hangers should be bolted to their upper ends as outlined in Fig. 3.

A portable bench for the conduit wireman is shown in Fig. 5. This device has been particularly useful where the bench has for some reason or other to be dismantled for transportation. It can be readily knocked down and shipped by rail in a relatively small chest at materially less cost than an unknocked-down bench can be transported. Benches of essentially this same style have been used by pipe fitters in the Western states where it was necessary to transport the tools on pack animals. To knock down the bench, the unions, of which there are six, are unscrewed. Pipe flanges are mounted at both ends for the supporting

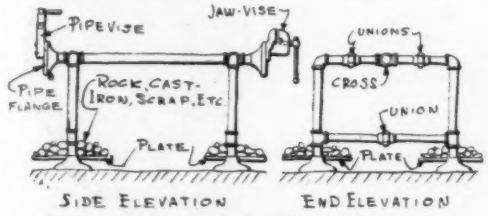


Fig. 5.—A Knock-down Pipe Bench.

of the conduit vises. Boards, if they are available, can be laid across the pipes at the top of the bench. They can also be laid across the bottom pipes to form a shelf. The plates are laid with heavy material of some sort to prevent the bench from rocking while pipe is being threaded. Where boards are placed across the lower pipes the load can be put on these instead of on the plates. It will be noted that every portion of the bench proper is of metal, making it very durable.

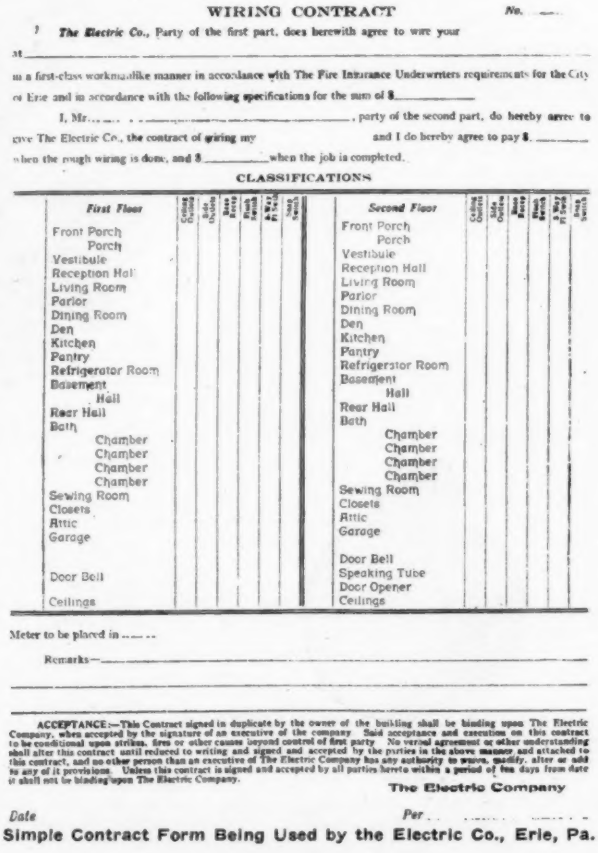
(To be continued.)

ESSENTIAL FEATURES OF CONTRACT FORMS FOR HOUSE WIRING.

Form Prepared by Erie (Pa.) Electric Co. Embodies Many Desirable Features.

In the wiring of old residence and small apartment buildings, especially old buildings, the contract or proposal form on which the estimate is submitted is a matter of considerable importance. Contracts in such cases are an important factor in their own sale as they are usually submitted to the owner of the building who is often ignorant of electrical and legal terms and therefore timorous of contracts containing them. For this reason it is very desirable such terms be eliminated as much as possible in the contract form and at the same time the work to be done should be clearly and prominently brought out so that it can easily be understood. Furthermore, estimates on such work should be sent in answer to every inquiry, whether the prospect appears good or not, and on this account the form should be such that it can be filled out easily and quickly by the contractor.

The form of contract shown in the accompanying illustration was prepared and is being used by the Electric Co., 620 Penn street, Erie, Pa., and answers these requirements very satisfactorily. The letterhead of the company appears at the top of the contract and



WIRING CONTRACT No. ____

The Electric Co., Party of the first part, does herewith agree to wire your

at _____

in a first-class workmanlike manner in accordance with The Fire Intirance Underwriters requirements for the City of Erie and in accordance with the following specifications for the sum of $_____

I, Mr. _____, party of the second part, do hereby agree to give The Electric Co., the contract of wiring my _____ and I do hereby agree to pay $. _____ when the rough wiring is done, and $_____ when the job is completed.

CLASSIFICATIONS

First Floor	Ceiling Outlets	Side Outlets	Base Plugs	Push Buttons	Key Sockets	Push Switch
Front Porch						
Porch						
Vestibule						
Reception Hall						
Living Room						
Parlor						
Dining Room						
Den						
Kitchen						
Pantry						
Refrigerator Room						
Basement						
Hall						
Rear Hall						
Bath						
Chamber						
Chamber						
Chamber						
Chamber						
Sewing Room						
Closets						
Attic						
Garage						
Door Bell						
Ceilings						

Second Floor	Ceiling Outlets	Side Outlets	Base Plugs	Push Buttons	Key Sockets	Push Switch
Front Porch						
Porch						
Vestibule						
Reception Hall						
Living Room						
Parlor						
Dining Room						
Den						
Kitchen						
Pantry						
Refrigerator Room						
Basement						
Hall						
Rear Hall						
Bath						
Chamber						
Chamber						
Chamber						
Chamber						
Sewing Room						
Closets						
Attic						
Garage						
Door Bell						
Speaking Tube						
Door Opener						
Ceilings						

Meter to be placed in _____

Remarks—_____

ACCEPTANCE:—This Contract signed in duplicate by the owner of the building shall be binding upon The Electric Company, when accepted by the signature of an executive of the company. Said acceptance and execution on this contract to be conditional upon strikes, fires or other causes beyond control of first party. No verbal agreement or other understanding shall alter this contract until reduced to writing and signed and accepted by the parties in the above manner and attached to this contract, and no other person than an executive of The Electric Company has any authority to waive, modify, alter or add to any of it provisions. Unless this contract is signed and accepted by all parties hereto within a period of ten days from date it shall not be binding upon The Electric Company.

The Electric Company

Date _____ Per _____

Simple Contract Form Being Used by the Electric Co., Erie, Pa.

at the bottom is a place for the owner's signature. In this form confusing legal phrases have been eliminated entirely and the contract states simply the cost of the work and the conditions under which it is to be installed. This includes the statement that the work when completed shall conform with Underwriters' requirements for the city of Erie.

The work to be done is also described very clearly and prominently. The rooms on each floor are listed separately and opposite each room space are columns in which may be checked the number of outlets, switches, etc., to be installed in that room. In this way the customer can tell at a glance just what work will be done without having to consider a confusing description of the electrical terms entering into the installation.

New Appliances

Flood-Light Projector Developments — Cast Squirrel-Cage Rotor — Washing Machines—Arcmaster Drum Controller

Developments in Crouse-Hinds Flood-Light Projectors.

Rapid development in the application of flood-light projectors took place during the war, especially for protective lighting of industrial and military establishments and the effective illumination of factory yards, freight yards, docks, aviation fields, etc. Now that all war restrictions on lighting have been removed, it is very likely that many further applications of flood lighting will be made, which will call for a variety of projectors for different purposes. It is therefore opportune to review the recent developments in one of the best known lines of projectors—the Imperial flood-light projectors made by the Crouse-Hinds Co., Syracuse, N. Y.

These projectors have been on market several years during which their scientific design and practical construction have led to their extended use for a variety of purposes. They are made in two general types: the SC type for illuminating wide areas relatively close to the projector and employing standard multiple Mazda C lamps with the ordinary filament construction; the SD type for throwing concentrated beams to a considerable distance from the projector and employing focusing type lamps with special concentrated filaments. The SC projectors are made in one size only with 16-in. diameter reflector and are designed especially for 1000-watt lamps, although they will accommodate any standard Mazda C lamp down to 300 watts. The SD projectors are made in three sizes with reflectors of 9⅝, 12 and 16-in. diameter; they are made to be used for different sizes of lamps ranging from 100 to 500 watts, each size projector being adapted to use two or three different lamp sizes. Each type and size projector is made with different mountings for different requirements.

Fig. 1—Type SCA Projector, Showing New Ventilating Hood.

A slight change was recently made in the design of the casing for the SC type of projectors. As now made the casing has a hood at the top. This gives more room for the mogul socket used and affords better ventilation, an important feature in view of the fact that the units are designed for use with 1000-watt lamps. The projector shown in Fig. 1 is of this type, its exact designation being type SCA. Its mounting consists of a combined swivel base and quadrant, the former providing means for revolving the projector as much as 360° about a vertical axis and the quadrant permitting any desired elevation or depression Each adjustment can be locked.

Fig. 2—Type SDXN Projector with Number Boxes at the Sides.

Fig. 2 shows an innovation in the SD line of projectors. This consists of illuminated number boxes that are found of great value for river, harbor and patrol boats; they can also be used advantageously on watch towers, signal stations and the like. In any case they serve to identify the boat, tower or other unit. A number box is provided on each side of the projector. The number is illuminated by an auxiliary incandescent lamp of 40 watts or less, these lamps being on a separate circuit so that they may be kept burning while the searchlight itself is turned off. The number boxes are made of cast iron, secured to the main casing in a water-tight manner and provided with a hinged and well gasketed, water-tight door sealed by three wing-nut catches. The number stencil is placed between two sheets of glass, of which one is diffusing and the other clear. Two 3-in. Arabic numerals may be used in each stencil. This projector is designated as type SDXN. As shown in Fig. 2 it has a pedestal mounting with wheel control. It is designed for mounting on the roof of the pilot house or tower, thus making the wheel convenient for readily turning the projector around horizontally or elevating and deflecting it. Contact from the projector to the circuit is made through three contact rings within the pedestal, of which one is in common in both the projector and number circuits and the other two are connected to the other side of each of these circuits.

Fig. 3—Type SAA Projector with Lamp Inclined to Permit Pointing Downward.

Fig. 4—Type SAE Projector with Inclined Lamp and Trunnion Mounting.

In Figs. 3 and 4 are shown two entirely new types of projectors, known as types SAA and SAE, respectively. They are unique in having the lamp mounted 30° back of the vertical to permit pointing the projector almost straight downward for lighting the adjacent ground from the top of a building. This may be done while still leaving the lamp burning in proper position, that is, within 45° of the vertical with base up, which is a requirement in the Mazda C lamps with regular filaments. For instance, by tipping the projector 75° forward and downward the lamp will still be within 45° of vertical and the center of the beam will be within 15° of the base of the wall, to which the light will extend because of the spread of the beam. The difference between the units shown in Figs. 3 and 4 is only in the mounting,

the former having a swivel base and quadrant, as in Fig. 1, while the latter has a swivel base and trunnions. The latter method of providing for tilting the unit is preferred in some cases. Both these projectors have 12-in. reflectors and are rated at 250 watts; the 200-watt focusing lamp or any ordinary filament Mazda C lamp up to 200 watts may be used for exact focusing. As with practically all the Imperial projectors, these units may be provided with either crystal-glass mirror reflectors, or with nickel-plated copper or polished aluminum reflectors to suit the desire of the purchaser.

Locomotive Washer Uses Novel Method.

A new electrically operated washing machine, embodying an entirely new method to secure the necessary water agitation has recently been placed on the market by the Remmert Manufacturing Co., St. Louis, Mo. It is built on a principle in which every drop of water is constantly in action, similar to a steam locomotive and for this reason is called the Locomotive washer.

In this machine the clothes receptacle contains no moving parts, which eliminates any possibility of tearing the clothes. By means of reducing gears and an eccentric the entire receptacle or tub is moved horizontally over a runway about 6 in. long. This movement causes a violent agitation of the water and clothes in the form of a figure 8. In this way the water is forced through the fabric which is cleansed thoroughly and quickly.

A gas heater or oil burner is attached to the framework of the machine by which the water can be kept at the boiling point. In addition to being very convenient for heating the water this attachment permits the use of steam in the tub which hastens the cleansing action and sterilizes the clothes at the same time. A swinging wringer with a safety attachment is also provided which may be used in any position.

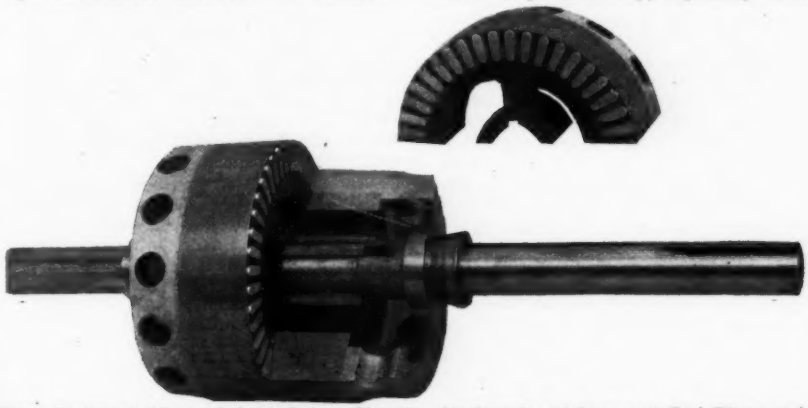
This machine is very compact and substantially built and all moving parts are inclosed. It is simple in construction and easy to operate. It is furnished with either a galvanized iron or copper tub.

Squirrel-Cage Induction-Motor Rotor with Cast Conductors and End Rings.

A new type of rotor with cast winding which has been recently designed by the General Electric Co., Schenectady, N. Y., presents new features and improvements worthy of description.

The copper bars and short-circuiting rings comprising the windings employ the same material and are cast in a single operation. With the windings thus made a solid unit with exceptional rigidity, durability and better balance is secured. The cast winding from an electrical point of view also insures uniform cross-section and union between the bars and the end rings. This has become a factor in eliminating operating difficulties due to open-circuiting of joints between bars and end rings.

Holes bored radially through the cast end rings give effective ventilation for rotation in either direction. The new cast-winding rotor is especially effective on induction motors of the squirrel-cage type. The accompanying illustration shows a sectional view of the cast rotor.



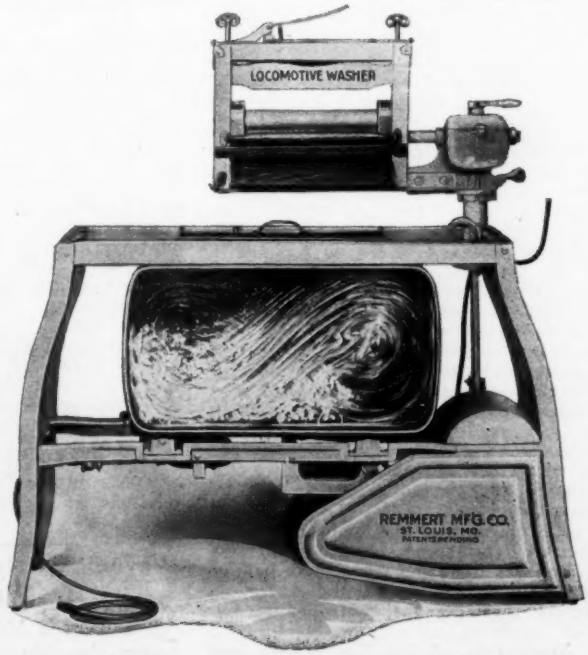
Part Sectional View of Cast Rotor, Showing Uniformity of Bars and End Rings and Ventilating Holes in Latter.

Arc-Master Equipment for Drum Type Controllers.

The drum type controller is very widely used for electric mining locomotives, cranes, hoists, derricks and other heavy machinery, especially such as is subject to reversal. When such a drum controller is used in service that is particularly severe, as when there is very frequent reversing, plugging and inching, the contacts are subject to severe arcing which causes high maintenance and frequent trouble. This matter is taken care of, in the case of some drum-controller installations, by providing an automatic control panel which limits the introduction of the current to safe values at the different steps and also affords full protection against overloads at all times.

To simplify the equipment and at the

New Locomotive Washer.



Vigorous Water Action Obtained in Tub Without Inside Mechanism.

same time secure practically all the protection of a separate automatic control panel, the Union Electric Manufacturing Co., Milwaukee, Wis., has placed on the market what is known as the "Arc-Master" equipment for weatherproof drum controllers. This equipment was designed with the assistance of the Automatic Reclosing Circuit Breaker Co., of Columbus, Ohio, which will build part of the apparatus. The outfit consists of two additional pieces of equipment besides the controller: the Arc Master proper, which is a simple attachment secured to the head of the drum, and a separate but compact automatic protective panel. Three pilot circuit wires run from the Arc Master to the panel, the wiring being substantially as shown herewith.

One of the distinctive features of the equipment is that the operator can rotate the handle only in the direction he wishes to go and he can advance the motor speed only as the motor is capable of properly picking up its load. In other words, acceleration, plugging and reversal are limited to safe values, so a new or careless operator cannot injure either the motor or controller. The controller is operated substantially free of arcing at all times. All circuits breaking heavy currents have the arc broken on the solenoid switch, which is especially designed for this purpose. Burning of contact fingers and arc deflectors is thus eliminated and the contacts remain in working condition.

A ground or short-circuit on any of the electrical parts which causes heavy current to flow while the controller is on can readily be broken with the solenoid switch. Greater safety is secured as the Arc Master eliminates any chances for the controller to fail to open the circuit.

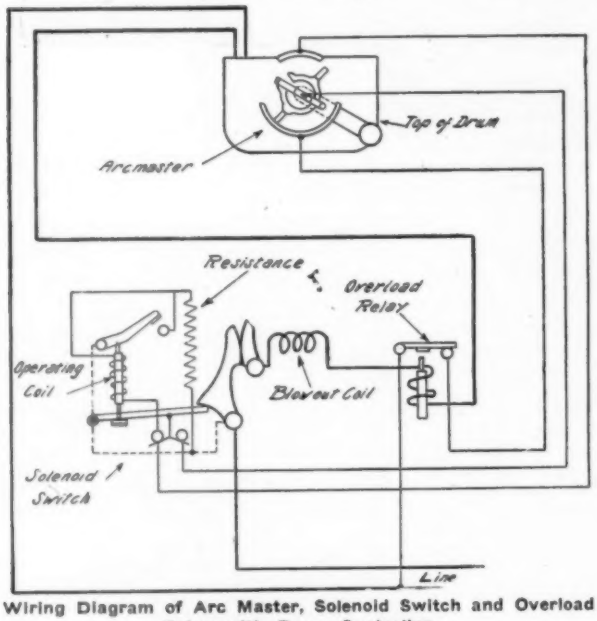
The opening of the main circuit by the Arc Master and solenoid switch accomplishes the same purpose as pulling the main switch to take the power off before throwing the controller to the "off" position.

Application of the Arc Master and solenoid switch to controllers which have proven too small for the work will make them suitable for long periods of useful service. If the Arc Master and solenoid switch should become inoperative for any reason whatever, the controller can be operated the same as any controller without this attachment.

The Arc Master is mounted on the head of the controller and is operated by the motion of the standard controller handle. In appearance it is like a cylindrical can, 6 in. in diameter and 3 in. in height, with three wires handling a pilot circuit to the solenoid switch. The latter is of a specially constructed magnetic blowout type. It is rugged, massive, and designed for continuous duty. The contact parts are of solid copper, very liberally proportioned and they are renewable. Wear is automatically taken up and its action is quick and positive. The solenoid switch is mounted on a slate panel which can be mounted anywhere conveniently.

The Arc-Master equipment protects motors from being started on account of the controller having been left in running position in case voltage is off the line momentarily for any reason and again restored. With this equipment, after voltage failure on the line, it is necessary for the controller to be moved to the "off" position and again to the first running position before the solenoid switch will close to energize the controller. This is an important safety feature.

When specified, a simple overload relay is furnished which protects the motor not only from low voltage but also from overload. Both features are automatic in reclosing when conditions return to normal. With this additional overload relay the controller fully protects the motor from low voltage and overload in addition to eliminating all arcing.



Wiring Diagram of Arc Master, Solenoid Switch and Overload Relay with Drum Controller.

Wayne Vacuum-Type Electric Washer.

The Wayne Manufacturing Co., St. Louis, Mo., has just introduced a new electric washing machine of the vacuum type to be called the Wayne No. 50. This machine employs a single vacuum cup which is worked up and down in the tub by an electric motor forcing the soap, water and air through the fabric of the clothes to be washed.

The tub itself is of red cypress wood, corrugated to increase the water agitation, and is mounted on an iron frame. The action is controlled by a small lever on the top of the lid and is automatically shut off when the lid is raised. The vacuum cup is of galvanized iron, riveted with copper rivets to a casting attached to the handle. The casting also acts as a wing and helps to change the position of the clothes on each stroke of the cup. A swinging power wringer is attached to the tub. This wringer is fitted with a releasing device which stops and releases the rolls instantly in the event that the clothes become wrapped around them.

Another feature of this washer is the detachable platform which provides a convenient stand for an extra tub and clothes basket which adds greatly to its convenience.

The machine when set up takes up a space 47 by 47 in., which is reduced to 47 by 28 in. when the platform is detached.

View of No. 50 Wayne Vacuum Washer, Showing Detachable Platform for Extra Tubs or Basket.

Lamp-Dimming Device Improved.

The "Anylite Regulator," or lamp-dimming device, that was placed on the market by the Anylite Electric Co., Fort Wayne, Ind., several years ago, has been improved in several particulars and is now said to be exceptionally rugged for service with any lamp not exceeding 40 watts. The earlier rating of 60 watts has been reduced to safeguard against burnout of the resistance element or traveling contact. There are now some 20 changes between full brightness of the lamp and "off," these being obtained by pulling the dark chain to the desired extent; brightening of the light is obtained by pulling the light chain.

Trade Activities

Fowle & Cravath Organize—Pratt & Whitney to Manufacture Hoke Gages—Black & Decker Appoint Representative

Frank Morse has sold his interest in the American Electric Co., Janesville, Wis., to O. V. Emmons. Mr. Emmons, with his brother, G. W. Emmons, will continue to operate the business under its present name.

Bleadon-Dun Co., 11-17 South Desplaines street, Chicago, manufacturer of violet ray high frequency machines, has removed its offices to the second floor of the Hearst building. Thus the entire space occupied by the offices will be given over to manufacturing and enable the company to increase its output and keep pace with its steadily increasing business.

Dubilier Condenser Co., Inc., 217 Centre street, New York, N. Y., is distributing a 32-page booklet which contains a complete record of the invention, development and uses of the Dubilier mica condenser. The booklet is well illustrated and contains much interesting information concerning apparatus used in radiotelephony and radiotelegraphy.

The Cooling Tower Co., Inc., 15 John street, New York, in a bulletin recently issued describes a new type spray nozzle for cooling ponds, which produces a flat fan-shaped spray. It is the result of development work in which engineers of the company have been engaged for the past two years, who after an extensive series of experiments and tests in the laboratory of the Stevens Institute of Technology, and at various spray plants in operation, have developed a nozzle which eliminates the defects in this method of cooling. The troubles, their cause and remedy are discussed in the bulletin which also contains illustrations and data taken during tests and outlines the principles of operation of spray cooling.

The Electric Hoist Manufacturers Association, 9 West 40th street, New York, is distributing a valuable booklet entitled "The Strong Army of Industry," which contains an excellent treatise on the electric hoist. While the diversified service demanded of electric hoists is recognized, it is stated that the availability for a still greater variety of hoisting and conveying work is not generally known. The booklet gives to the reader some conception of the almost unlimited field of usefulness for overhead electric hoists and an idea of their adaptability to practically every branch of industry. In this publication twenty-two different electric hoist applications are depicted, and while not indicative of the scope of service rendered by the electric hoist, they serve to suggest an adaptation to almost every line of work that will effect a material saving in labor or time, or perhaps both.

Despatch Manufacturing Co., Minneapolis, Minn., manufacturer of electric ovens and heating appliances, has moved into larger and more commodious quarters, occasioned by the constantly growing demand for electric ovens and heating appliances necessitated larger quarters. The new factory is located at 116-122 First avenue, North, and provides over an acre of floor space.

The Van Dorn & Dutton Co., Cleveland, manufacturer of gears, has opened branch offices at Chicago and New York. At both cities it is the company's purposes to specialize in gears and pinions for electrical work. Harry F. Keegan, formerly with the Chicago Surface lines and well known in the electrical railway field, will manage the Chicago branch, with offices at 1241 First National Bank building. His brother, John Keegan, will manage the New York branch, with offices at Room 317, 30 Church street. He comes from the Interboro railway, where a third brother is now engaged.

Wheeler Condenser & Engineering Co., Carteret, N. J., in the month of April manufactured and shipped 879,900 lb. of seamless drawn brass and copper condenser tubes. Its Crescent brand tubing is in great demand because of its excellent corrosion resisting properties. Users find that it pays to use the highest quality of tubing in condensers, heaters, evaporators, reboilers, etc. This manufacturer is peculiarly well fitted for making tubing of this kind because of its broad experience in the manufacture of condensers and condensing equipment. Where desired, the research department of this company investigates each user's individual problems.

Hawthorne Co. is the name of a company recently organized which represents a consolidation of the Hawthorne Manufacturing Co., Inc., Bridgeport, Conn., manufacturer of spotlights, flashlights, etc., and Hamilton & DeLoss, Inc., manufacturer of special sheet metal goods. The new corporation is capitalized at $1,500,000 and occupies the recently completed plant of the latter company, which comprises about seven acres of ground, located in Fairfield, Conn. The consolidation will provide greatly increased manufacturing facilities and will enable the new company to enlarge its output of lamps and lighting devices in sheet metal. The officers of this organization are as follows: E. W. Bassick, chairman of the board; president, H. H. DeLoss; vice-presidents, H. H. Hamilton and E. A. Hawthorne; treasurer, H. H. DeLoss; assistant treasurer, Arthur D. Sullivan; secretary, E. Horace Hawthorne.

Black & Decker Manufacturing Co., Baltimore, manufacturer of portable electric tools, electric air compressors and special machinery, announces the appointment of George R. Lundane as manager of the New York offices just established in the Equitable building. Mr. Lundane was formerly connected with the Thomas B. Jeffery Co., Kenosha, Wis., as service manager of the Kansas City plant. He was recently associated with the Findeisen & Kropf Manufacturing Co., Chicago, in the capacity of eastern district sales manager. With the establishment of the New York offices, the Black & Decker company has branches in virtually every leading city of the country. The company maintains offices in New York, Philadelphia, Atlanta, Ga., San Francisco, Chicago, Detroit, Columbus, Ohio, Buffalo and Boston, and headquarters in Baltimore. It also has foreign connections in England, France, Norway, Sweden and Japan.

Pratt & Whitney Co., Hartford, Conn., has secured the manufacturing rights for the Hoke precision gages, which are now being made at the Bureau of Standards as inspection and reference sets for army and navy use. The demand for gage blocks last year exceeded the supply and the Army Ordnance commandeered a considerable percentage of importations to meet its urgent requirements. A great deal of experimental work has been done in the toolrooms of this country in attempts to produce flat parallel opposite faces on size blocks of accurate length and it is believed that William E. Hoke, of St. Louis, has the honor of first producing in this country gage blocks superior to the imported article. The blocks were produced at the Bureau of Standards by Mr. Hoke, first as an employe of the Bureau, and later as a major of Ordnance Department, U. S. A., the Ordnance Department at the same time appropriating $50,000 to manufacture gages for the Army. There were developed methods of manufacture and measurement almost unbelievably accurate. The Bureau of Standards is now producing Hoke blocks within limits of three millionths of an inch, and the greater part of these show no error of a millionth. The measurements are made by optical methods and are, of course, quite beyond the reach of ordinary shop practice. Each set of these gage blocks is accompanied with a signed certificate from the Bureau of Standards, identifying the particular gage blocks by serial numbers, and with a statement of the actual errors found in each block. The company has adopted a design of block approximately 1 in. square, with a ¼-in. countersunk hole through the

center, and it is believed that this design will be found more convenient than the rectangular shape in common use. The Hoke gages are glass-hard, of special alloy steel selected for its wearing qualities and permanence, thoroughly seasoned and beautifully finished. The first sets ready for the market will consist of five blocks, 1 in., .5 in., .6 in., .2 in., .1 in., giving any tenth up to 2 in.

The American Steam Conveyor Corp., Chicago, announces the appointment of N. B. Stewart as district representative in charge of its St. Louis territory. Offices have been opened at 708 Merchants-LaClede building, St. Louis, Mo.

Schmitz Electric Co., Manitowoc, Wis., has been organized and succeeds to the business of George Wolf, located at 1208 Washington street. Members of the firm are Raleigh and Homer Schmitz, and the concern will engage in a general electrical business, and will also conduct a store with a full line of supplies.

E. C. Atkins & Co., Inc., Indianapolis, Ind., is distributing a new booklet which has for its subject Atkins circular metal cutting saws designed for various makes of machines. Detailed information as to diameter, thickness, size of hole, pitch of teeth, price, etc., is given, accompanying which are illustrations of the various saws and reproductions of the pitch of teeth. These saws are scientifically constructed, well adapted to the cutting of different kinds of metal and will withstand the severest test.

Benjamin Electric Manufacturing Co., Chicago, Ill., has prepared several very elaborate sales helps for the dealer, which are bound to aid him in the sale of the Benjamin Two-Way plug. The company is conducting a very extensive advertising campaign in 31 leading national magazines of the country, and it will be remembered by the dealer that all of this advertising is doing much more for him than merely selling plugs, it is increasing his sales on all household electrical appliances and is building up his business on the reputation of this national advertiser. A new 28-page sales-help book has been prepared, which represents one of the strongest, broadest and most comprehensive sales services extended by a manufacturer to a distributor of an electrical specialty. In this book are reproduced some of the attractive advertisements used by the company, presenting strong and convincing arguments for the Benjamin Two-Way plug. Besides illustrated folders, stickers, newspaper electrotypes, etc., the company is furnishing colored wall hangers and advertising display cartoons. These are made up in colors designed for either counter or window trim.

Fowle & Cravath Engineering Partnership Formed.—Frank F. Fowle, until recently one of the receivers of the Central Union Telephone Co. and formerly consulting engineer, and James R. Cravath, well-known consulting electrical and illuminating engineer of Chicago, have formed an engineering partnership under the firm name of "Fowle & Cravath," with offices in the Monadnock Block, Chicago. Both partners are men who have made national reputations in their work and are especially well known in Chicago and the Middle West. The services of the firm will be devoted to investigations, research, design, supervision, management, appraisals and rate cases, in the several fields with which the partners have heretofore been identified.

Mr. Fowle was graduated from the

Frank F. Fowle.

Massachusetts Institute of Technology in 1899, in the electrical engineering course, and then served nine years with the American Telephone & Telegraph Co. in various capacities in the engineering, railway and operating departments, finally serving as manager of the Chicago territory of the long-lines system. From 1908 to 1912, Mr. Fowle was in practice as a consulting engineer, with headquarters in Chicago, during which period he served numerous important interests, both corporate and municipal.

James R. Cravath.

In 1912 he went to New York and jointly with Dr. A. S. McAllister was in charge of the editorial department of *Electrical World*. In 1913 Mr. Fowle became editor-in-chief of the "Standard Handbook for Electrical Engineers," published by the McGraw-Hill Book Co., and again entered engineering practice, in New York. Early in 1914 he was appointed one of the receivers of the Central Union Telephone Co., in connection with the Read suit, by Judge William E. Dever of the Superior Court of Cook County, Ill., the other receivers being David R. Forgan and Edgar S. Bloom. Messrs. Fowle and Bloom served as the chief executive and operating officials of the system throughout the five years of receivership, until recently discharged by the court in consequence of the settlement of the litigation.

Mr. Fowle is an active member of many technical societies and has served on many of their committees. He was chairman of the Telephony and Telegraphy Committee, American Institute of Electrical Engineers, and has just been made a member of the Development Committee, Western Society of Engineers. He has also just been elected a manager of the American Institute of Electrical Engineers, and re-elected manager of the Chicago Section, Illuminating Engineering Society.

Mr. Cravath graduated with the degree B. S. in 1892 from Grinnell College, Grinnell, Iowa. From 1892 to 1907 he was electrical editor of the *Street Railway Review* of Chicago. In 1900 he became western editor at Chicago for the *Electrical World* and other McGraw publications, remaining on the regular staff until 1910, when he began to give his time to consulting engineering and executive work, in which he has been engaged ever since. During the last ten years of his editorial experience, he became specially interested in illuminating engineering and did consulting expert work in that line among the pioneers in that field. His editorial work among central-station companies also led to his becoming interested in a financial and executive way in several small public service properties. He was for four years president of the Lawrenceville (Ill.) Light & Water Co. and for two years secretary, treasurer and managing director of the Peoples' Water & Light Co. of Harrisburg, Ill. For the past five years, since its organization, he has been president and treasurer of the Tri-City Artificial Ice Co. of Rock Island, Ill., which operates an electrically driven modern ice plant, which is the chief source of artificial ice supply to the cities of Rock Island and Moline. For two years he had general charge of the Menominee Range Power Co., giving electric service in the Iron River mining district of Michigan.

In a consulting capacity, Mr. Cravath has served many companies and municipalities in connection with street-lighting plans, alterations, contracts, public utility rates and appraisals, and power-plant economies. He is perhaps best known through his prominence in the illuminating engineering field. He is one of the authors of "Principles of Interior Illumination" and of "Practical Illumination," and the author of "Street Lighting for Small Towns and Cities." He has held numerous offices and served on many committees in technical societies in the electrical and illuminating field. He was the first secretary of the Chicago Section of the Illuminating Engineering Society and later chairman, director and vice-president. He is at present chairman of the Electrical Section of the Western Society of Engineers.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Springfield, Vt.—Arrangements are being made by the Colonial Light & Power Co. for extensive additions and improvements to practically double the present capacity. The company's plans include the erection of a new electric substation and administration building on Clinton street, one-story, about 25x75 ft., contract for which was recently awarded, with a new outdoor substation. It is expected that the work will be completed by the commencement of the coming fall. Installation of a quantity of new equipment at the Cavendish hydroelectric power of the company is under way, to facilitate operations.

Springfield, Mass.—The United States Government has awarded a contract to the A. E. Stephens Co., 318 Main street, for the proposed alterations and improvements in the engine plant at the Arsenal, Hill Shops. A two-story and basement addition to this plant will also be erected, the entire work being estimated to cost $25,000.

Hartford, Conn.—Hartford Rubber Works has awarded a contract to the J. H. Crozier Co., 721 Main street, for the erection of a one-story addition to its plant, 60x79 ft., to cost $34,000.

Buffalo, N. Y.—Lloyd A. Wooley has recently leased property at 83-85 Ellicott street, and will operate an electric fixture establishment.

New York, N. Y.—In a report recently made by the Department of Commerce, it is set forth that the various electric light and power stations in the United States during the year 1917 generated more than 25,000,000,000 kw-hr. of electric energy, which produced an income in excess of $500,000,000.

New York, N. Y.—Negotiations have been completed by Bank & Heller, operating a local electrical contracting establishment for the leasing of property at 468 Seventh avenue, for a new establishment.

Troy, N. Y.—Large quantities of electrical machinery, equipment, etc., will be required by the Ordnance Department, Washington, in connection with the proposed extensions to the Arsenal at Watervliet, near Troy. It is understood that about 35 additional acres of land will be acquired, and plans are under consideration for the erection of a number of large additions, a portion of the works to be equipped for the production of 14-inch guns. Upon completion of the additions, employment will be available for about 7000 persons, the expansion program calling for the expenditure of over $10,000. It is understood that the Watervliet Arsenal will be the principal plant of its kind in the country. Colonel Mettler is in charge.

Watertown, N. Y.—Northern New York Utilities Co. is having bids taken by James P. Brownell, Carthage, N. Y., for the construction of a concrete and steel power plant, dam and canal on Black river, Watertown, to cost approximately $250,000.

Hoboken, N. J.—Following the formal transfer to the United States Government of three of the six German owned piers on the Hoboken water front on May 3 for a consideration said to be about $2,500,000, it is understood that extensive improvements and alterations will be made, including the erection of a large new electric power plant to be used to supply electric energy for the piers, the replacement of wooden Pier No. 6 by a modern double-deck pier of concrete and steel.

Newark, N. J.—Murray Wire Co. has completed negotiations for the leasing of the one-story building at 491 New Jersey Railroad avenue, formerly occupied by H. D. Parmelee & Co., for a new establishment.

Ephrata, Pa.—Harry Eby Shoe Co. has had plans prepared for the construction of a new four-story brick factory building, about 42x99 ft., and one-story power plant, 39x43 ft., to provide for increased operations. W. E. S. Dyer, Land Title building, Philadelphia, is architect for the company.

Philadelphia, Pa.—Scott-Powell Dairies, 45th and Parrish streets, have had plans prepared for the installation of new boiler equipment at their plant, to provide for increased operations.

Logan, W. Va.—Guyan Machine Works will receive quotations on 25-hp. electric hoists, hoisting drums, 44 and 48-in. gage storage battery locomotives and 6 and 8-in. cast-iron pipe.

Spencer, W. Va.—The city contemplates constructing a power plant. Address Mayor Wieland.

Hagerstown, Md.—Rupp Manufacturing Co. will purchase new equipment of all kinds to replace that destroyed in the fire which recently wiped out its plant. It will be rebuilt immediately.

Lynchburg, Va.—Southern Electro Steel Co. will install an electric steel foundry with one-ton electric furnace, core oven, drying oven, annealing oven, heat-treating plant, sandblast equipment, traveling cranes, etc.

Wilmington, N. C.—Hamme Marine Railway desires prices on 15 or 20-hp. electric motors, etc. Address R. F. Hamme, Jr., 106 North 4th street.

Cornelia, Ga.—The plant of the Wofford Shoal & Light Co. will be enlarged. The transmission lines will be extended. Address W. B. Ellard, manager.

Unadilla, Ga.—The city is understood to be making preliminary arrangements for the erection of an electric light plant, to be used for municipal service. It has not been announced as to the exact time when the plans will mature. C. B. Morgan is mayor.

Pensacola, Fla.—The Bureau of Yards and Docks, Navy Department, is planning extensions and betterments in the electric power plant at the naval works at Pensacola, to cost about $50,000.

NORTH CENTRAL STATES.

Springfield, Ohio.—Clark County Lumber Co. will erect an 80x140 planing mill to be equipped with electricity.

Evansville, Ind.—The remodeling of the New Majestic Theater, to cost between $50,000 and $75,000, will demand a large installation of electrical fixtures. Address Harry E. Boyle & Co., Evansville, Ind.

Fort Wayne, Ind.—Thieme Brothers Co. will erect a four-story factory building, 90x157 ft., face brick, cement and steel construction, to cost $150,000.

Huntington, Ind.—J. F. Bippus, president of the Huntington Light & Fuel Co., will erect a $250,000 hotel building.

Kokomo, Ind.—M. J. Hoffman Construction Co., Evansville, Ind., has been given contract for the erection of $450,000 addition to plant of Haynes Automobile Co. The addition will consist of new assembling plant and forge shops, 120x800 ft., four stories, brick, stone and reinforced concrete, with steel sash. This building is the first of a group to cost $1,500,000.

LaPorte, Ind.—Wanatah Electric Co. has increased its capital stock from $5000 to $10,000 and will enlarge its scope of work.

Mishawaka, Ind.—Plans are under way here for the formation of a $100,000 company to erect fireproof houses for the working classes of South Bend and Mishawaka.

South Bend, Ind.—Union Electric Co. has purchased a site for the erection of a large building.

South Bend, Ind.—Mishawaka Woolen Manufacturing Co. will erect a $25,000 three story, fireproof building.

Delavan, Ill.—Royal Light & Power Co. will build a transmission line from Delavan to San Jose.

Fisher, Ill.—$12,000 electric light bonds will be offered for sale. Address Oscar Zook, village clerk.

Quincy, Ill.—Quincy Railway Co. has entered into a contract with the Mississippi River Power Co. for the purchase of current from the power company.

Rockford, Ill.—A. C. Woods & Co., contracting engineers, will install a structural steel plant with heavy power driven machinery, the plant to manufacture complete steel shapes.

Detroit, Mich.—Stecker Electric & Machine Co. will erect a new factory building.

Cudahy, Wis.—Cudahy Brothers Co. will build a power plant addition and install a 600-kw. generator set and two 400-hp. boilers. Michael F. Cudahy, president and general manager.

Milwaukee, Wis.—Chicago, North Shore & Milwaukee railroad will start work soon on its new $250,000 depot and terminal station on Sixth street, between Sycamore and Clybourn streets.

Racine, Wis.—Webster Electric Co. is having plans prepared for the construction of a power plant and factory.

Altura, Minn.—A company has been organized to build an electric light and power plant to cost about $300,000. Address Power Engineering Co., 510 Corn Exchange, Minneapolis, Minn.

Davenport, Iowa.—White Lily Washer Co. will erect factory building, 220x225 ft., to cost $15,000.

Newton, Iowa.—Engineers Archer & Stevens, 609 New England building, Kansas City, Mo., have prepared plans for $175,000 electric light plant improvements. Address city clerk.

St. Louis, Mo.—Swift & Co. will expend $70,000 enlarging the power house.

Sikeston, Mo.—The city is understood to be arranging plans for the erection of a new electric light plant, to be used for municipal service. The structure is estimated to cost about $75,000, with equipment installation. C. C. White is mayor.

Kansas City, Kans.—The franchise of the Standard Electric Light & Power Co. will expire July 1 and will not be renewed. The city will take over the service which the company has been furnishing and will supply all consumers with the required current.

Liberal, Kans.—The council has perfected plans for establishing a new lighting system. It was decided that the system should embrace the principal streets, running north and south as far as the paving goes on Kansas avenue and East and West on Second street, the same distance. The business section of Lincoln and Third streets will also be taken care of.

Beatrice, Neb.—Committee of business men of Plymouth, 14 miles west of Beatrice, is arranging to build a transmission line from Beatrice to Plymouth and to secure a supply of current from Beatrice. Plymouth has been without electric service for a number of years and the business men wish this service. Address Harry Gerhardt, Plymouth, Neb.

Emerson, Neb.—On May 28 the question of issuing $20,000 municipal light bonds will be submitted to vote. Address village clerk.

Falls City, Neb.—A $150,000 courthouse will be erected here to replace one destroyed by fire.

Gregory, S. D.—The city will build a $25,000 municipal lighting plant. Address Gustave Reiter, mayor.

Sioux Falls, S. D.—Sioux Falls division of the Northern States Power Co. has closed contract with the Symns-Brownell Co. for 65 hp. in motors to be connected within thirty days. An additional ice-making unit is being installed by the J. W. Fenn Co., which will be served by the Northern States Power Co. to the extent of 35 hp. in motors. Addition to the McKennan hospital will be completed within the next 30 days at which time an additional 50 hp. in motors and 56 kw. in lighting will be added to the lines of the Northern States company.

DATES AHEAD.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 19-23. Secretary, T. C. Martin, 33 West 39th street, New York City.

Electric Power Club. Annual meeting, Hot Springs, Va., May 22, 23 and 24. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

Vancouver Association Electrical Contractors and Dealers. Convention, Vancouver, B. C., May 26 and 27. Secretary, Capt. W. J. Conway, 406 Yorkshire building, Vancouver, B. C.

Illinois Association of Electrical Contractors and Dealers. Summer convention, Decatur, Ill., June. Secretary, N. M. Blumenthal, 179 West Washington street, Chicago.

Electrical Supply Jobbers' Association. Annual convention, Hot Springs, Va., June 10, 11 and 12. Headquarters, The Homestead Hotel. Secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Tri-State Water and Light Association. Annual convention, Greenwood, S. C., June 17-19. Secretary-treasurer, W. F. Stieglitz, Columbia, S. C.

American Society of Mechanical Engineers. Spring meeting, Hotel Statler, Detroit, Mich., June 17-20. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Summer meeting, Boston, Mass., June 18-21. Secretary, Prof. J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

American Institute of Electrical Engineers. Annual convention, Adirondacks, N. Y., June 24-27. Headquarters, Lake Placid Club. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., October. General secretary, Clarence L. Law, 29 West 39th street, New York City.

SOUTH CENTRAL STATES.

Louisville, Ky.—The commercial department of the Louisville Gas & Electric Co. during the week ended May 3 secured 63 electric lighting and power customers with 34 kw. of lighting and 452 hp. in motors, and took contracts for wiring 16 already-built houses. New business connected to the company's lines shows an increase of 47 customers. There was a temporary loss of 77 kw. of lighting and 420 hp. in motors. The output of electric energy shows an increase of 10.9% over the corresponding week of last year.

Friendship, Tenn.—Marvel Mill Co. will purchase additional electric equipment. Address general manager.

Attalia, Ala.—H. M. Johnson of Gadsden, Ala., will install stiff mud brick outfit with 25 to 40 hp. electric motor power with daily capacity of 20,000 bricks.

Selma, Ala.—American Pipe & Construction Co. of Philadelphia, owner of the Selma Lighting Co., has petitioned for a renewal of the contract to furnish light and power to the city.

Port Gibson, Miss.—The city has voted to issue $25,000 in bonds to repair electric light and water works plant. Address mayor.

Senatobia, Miss.—The city has voted to issue $15,000 in bonds to install electric light plant. Address mayor.

Heber Springs, Ark.—Arkansas Hydro-Electric Development Co. is arranging plans for the construction of the proposed hydroelectric development at Heber Springs. The proposed work includes the construction of about three dams, each 50 ft. high, with initial dam and equipment estimated to cost about $500,000. The project is estimated to cost in excess of $3,000,000. Dickinson & Watkins, Little Rock, are engineers for the company.

Helena, Ark.—Helena Cotton Oil Co. will install equipment for the manufacture of cottonseed products, including presses, power plant, etc.

Blanchard, Okla.—The city has voted to issue $15,000 in bonds to construct electric light plant. Address board of trustees.

Tishomingo, Okla.—The city has voted to issue $50,000 in bonds to install electric light plant. Address mayor.

Dallas, Tex.—Texas Power & Light Co. of Dallas has purchased the electric light plant and transmission system at Stephenville. It is planned by the company to extend its power transmission system from its Brownwood plant to Stephenville. Several towns in Central West Texas are already being provided with power and lights from the Brownwood station. Additional machinery will be installed.

Fort Worth, Tex.—An ordinance has passed the council providing for

an issue of $1,800,000 improvement bonds. A part of the money will be used in the street lighting department of the city. Address mayor.

WESTERN STATES.

Carlsbad, N. Mex.—Public Utilities Co. is contemplating enlargements in its system.

Phoenix, Ariz.—A 4000-volt electrical transmission line 70 miles in length will be constructed immediately to bring power from the Arizona Power Co. lines near Highball, to the Pacific Gas & Electric Co. system at Phoenix.

Bremerton, Wash. — NePage-McKenny Co., Armour building, Seattle, was awarded contract for installation of the electrical equipment in the $24,000 building to be erected at this place by the Bremer estate.

Centralia, Wash.—Mendota Coal Coal Co. has completed arrangements for the complete electrification of its local properties, including the installation of generator equipment, a total of about 100 hp. in motors, pumping machinery, and auxiliary apparatus

Ferndale, Wash.—Whatcom County Light & Power Co. is making rapid progress on the installation of a new electric lighting system in Ferndale, and operation will be inaugurated at an early date.

Seattle, Wash.—Pacific Lamp & Supply Co. has recently been awarded a contract by the Board of Public Works for the furnishing of incandescent lighting units for the period of one year for municipal service. The contract price is about $100,000.

Seattle, Wash.—Appropriations aggregating $36,709.86 for extensions and improvements in the city lighting system have been approved by the finance committee of the Seattle city council.

Seattle, Wash.—Ames Shipbuilding & Drydock Co. has commenced construction of the first two pontoons of an 18,000-ton drydock, which will be built at the company's shipyard. Six pontoons will be built, each to have a lifting capacity of 3000 tons. Electrically driven pumping apparatus will be installed. T. A. D. Jones is general manager.

Vancouver, Wash.—At a recent meeting of the Better Government League a decision was made to begin a campaign at once through the different civic organizations for construction of a hydroelectric power plant to supply light, heat and power for lower Columbia basin residents at cost, it being the intention to have the government construct and own the plant.

Wenatchee, Wash.—Okanogan Valley Power Co. will soon begin work on the construction of a dam and power plant on the Similkameen that will generate 5000 hp. The new dam will be of reinforced concrete and will be 200 ft. high.

Astoria, Ore.—United States Shipping Board, Washington, D. C., and Astoria Marine Iron Works plan to build a marine railway on Young's Bay, including incline rollway and automatic electric ship hauling power, to have 6000 tons deadweight capacity. Cost, about $500,000.

Eugene, Ore.—Willamette division of the Mountain States Power Co. has secured contract with the Huber Construction Co. for 75 hp. in motors for the operation of a rock crusher near Lewisburg.

Reedsport, Ore.—Reedsport Power & Light Co. has contracted with the Marshfield Electric Co. for installation of a plant and distributing system here.

Banning, Cal.—Plans are under consideration by the city trustees for the purchase of the local light and power plant, to be used for municipal service.

Calexico, Cal.—The City Council has ordered a special election called for May 27, to vote on the issuance of bonds to the amount of $160,000, to provide for the construction of a municipal light and power plant.

Coalinga, Cal.—The city trustees are arranging plans for the purchase of the local plant of the Coalinga Gas & Power Co. with distributing system, to be used for municipal service. The consideration is estimated at about $40,000.

Fresno, Cal.—San Joaquin Light & Power Co. is understood to have inaugurated preliminary work on the construction of the proposed hydroelectric plant on the San Joaquin river near Auberry, the project being estimated to cost in excess of $2,000,000. A. G. Wishon is manager. The company is understood to be having preliminary surveys prepared, etc., for the construction of a large new power house in the vicinity of Stockton.

Fresno, Cal.—Umbsen, Kerner & Eisert, San Francisco, are understood to be arranging plans for the construction of a large new reservoir and dam on the Chowchilla river, near Fresno, to be used for irrigation purposes, the project being estimated to involve an expenditure of close to $300,000. O. L. Markley is local representative for the company.

Glendale, Cal.—General Electric Co. has recently been awarded a contract for furnishing to the municipal authorities a new 60-kv-a. 150-ampere Type C induction feeder.

Los Angeles, Cal.—Contract has been awarded by the Los Angeles Sea Food Packing Co. for the erection of a new boiler plant, about 26x27 ft., to be constructed in connection with two new additions to its plant on the Fish Harbor Wharf, San Pedro.

Los Angeles, Cal.—Golden State Electric Co., 748 West Seventh street, has recently been awarded contracts for the installation of electric wiring and motors for the operation of pumping equipment at the naval air station at North Island, San Diego, and the electrical work in connection with the erection of a new two-story structure being constructed by the Oncologic Institute at Sixth and Lucas streets.

Los Angeles, Cal.—Contract has recently been awarded by F. A. Kauffman for the erection of a number of new factory buildings at his plant on East Ninth street, near the Los Angeles river. The proposed work includes the erection of a new boiler and engine plant, about 60x80 ft.

Los Angeles, Cal.—In connection with the proposed erection of a large motion picture plant by the Bonnie-Reed Film Manufacturing Co., Niles, to be located on Sunset boulevard at Bronson avenue, plans are now being arranged for the construction of a large power plant for operation. The works will include offices, laboratories, warehouse, studios, grand stands, etc., and the entire project is estimated to involve an expenditure of approximately $1,000,000. Train & Williams, Exchange building, are architects.

PROPOSALS

Machine Tools.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for one motor driven bench grinder, delivery at Hampton Roads, Va. (Schedule 3953); six motor driven commutator grinders, delivery East and West (Schedule 3972); two telephone motor generators, delivery at Mare Island and Brooklyn (Schedule 3963), and one motor driven rotary shear with extra cutters, delivery at Mare Island (Schedule 3940).

Hoists.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for four electric whip hoists and spares for delivery at the Puget Sound navy yard (Schedule 3966).

Hoistway and Dumb Waiter.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., June 2, for the installation complete of a hoistway and electric dumb waiter in the United States Post Office and Courthouse at Pittsburgh, Pa., in accordance with the drawing and specifications. Copies may be had at the above office in the discretion of the Supervising Architect, James A. Wetmore, acting supervising architect.

Navy Electrical Wire, Cable. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, for the following supplies: 30 watertight, 6-inch bells, four 120-volt d. c. dynamotors, and spares, delivery at Brooklyn and Mare Island navy yards; miscellaneous telephone equipment, one pneumercator system for drainage-tank signal system, delivery at Mare Island, one pneumercator system for drainage-tank signal system, for delivery at Brooklyn; telephone switchboards (Schedule 3963); 3500 ft. lighting, armored, cable, miscellaneous quantity of lighting and power wire, delivery at Brooklyn navy yard (Schedule 3979); 75 120-volt electric heaters, delivery at Philadelphia navy yard (Schedule 3959); electric railroad material and hard-drawn copper trolley wire, delivery at Washington navy yard (Schedule 3956); 46,000 galvanized "Simens Martin" strands, delivery at Washington navy yard (Schedule 3962).

Personal

Raymond H. Smith Becomes Connected with Electric Bond & Share—Additional Honors Conferred on Gen. Harries

W. T. GREENLEAF, who was acting manager of the Cleveland office of the Allis-Chalmers Manufacturing Co., Milwaukee, during the absence overseas of R. S. Fleshie, district manager, has been appointed district manager.

LOUIS JALOVEC, electrical engineer and designer of X-ray apparatus, Chicago, was recently appointed assistant to the United States Foreign Trade Commissioner to Czecho-Slovakia. He will be stationed in Prague, Bohemia, and will furnish particularly information in regard to markets, although he will also give attention to inquiries for data of any kind regarding the country.

BRIG. GEN. GEORGE H. HARRIES, a vice-president of H. M. Byllesby & Co., and formerly president of the Louisville Gas & Electric Co., has recently had conferred upon him two new honors. One of these was the American Distinguished Service Cross conferred by General Pershing in recognition of his services at Brest in the early part of the war. The other was conferred by the French General Dupont, General Harries being made a commander of the Legion of Honor, also in recognition of his work at Brest.

CAPT. D. C. MCCLURE, who, before his entrance into the service of the United States, was an engineer with the Denver Gas & Electric Light Co., has returned to this country from France and has recently received his discharge from the army. Captain McClure received his commission after attending the first officers' training camp at Ft. Leavenworth. He was later assigned to the 89th division at Camp Funston and in May, 1918, was transferred to the 37th Engineers, which was formed at Fort Meyer, Virginia, primarily as a special electrical unit.

J. C. ROCKWELL has been promoted from local general manager to vice-president of the Manila Electric Railroad & Light Co., Manila, P. I., in charge of the general Philippine affairs of that company. This property is under the operating management of the J. G. White Management Corp., New York, N. Y. Mr. Rockwell was graduated in 1904 from Cornell University with the degree of mechanical engineer. Following his graduation he engaged in track construction work. In 1906 he became superintendent of transportation of the Syracuse (N. Y.) Lake Shore & Northern Railroad Co. He was appointed general superintendent in 1909 of the Charleston (W. Va.) Interurban Railroad Co., and the following year was elected general manager of this company. In 1911 he joined the operating organization of the J. G. White Management Corp., New York, N. Y., and was assigned to the Manila Electric Railroad & Light Co. as manager of the light and power department, and he was made general manager of that company in the early part of 1918.

RAYMOND H. SMITH, vice-president and general manager of the Eastern Wisconsin Electric Co., which owns the traction and lighting plants in Oshkosh and Sheboygan, has resigned to become connected with the Electric Bond & Share Co. of New York City. Mr. Smith will have charge of the Panama properties of the company, which is controlled by the General Electric Co., and is one of the largest operators of public utilities in the country. He will assume his new duties about June 1 and will have headquarters in New York City.

Mr. Smith entered the utility field with the Waterbury Traction Co., Waterbury, Conn., in 1897, and held various positions in the electric and railway departments until 1900, at which time he became assistant superintendent of the railway, and the same year was

Raymond H. Smith.

transferred to the headquarters of the Connecticut Railway & Lighting Co. at Bridgeport. In 1903 he was appointed superintendent of the company at Bridgeport and continued in this capacity until 1907 when he became general manager of the Albany & Hudson Railroad, Albany, N. Y. This company two years later, passed through a receivership, and Mr. Smith was made receiver. Later the company was reorganized as the Albany Southern Railway Co. and Mr. Smith was made general manager.

In 1912 Mr. Smith resigned to accept the appointment of general manager of the Jackson Light & Traction Co., Jackson, Mich., which position he held until 1916. In November, 1916, he was made vice-president and general manager of the Sheboygan Electric Co., Sheboygan, Wis. In March, 1918, the company was consolidated with the Wisconsin Electric Railway Co. of Oshkosh, and the Eastern Wisconsin Railway & Light Co. of Fond du Lac, Mr. Smith being made vice-president and general manager of the consolidated companies, the Eastern Wisconsin Electric Co. Mr. Smith has taken an active part in various organizations and was recently elected president of the Wisconsin Electrical Association and of the Wisconsin Gas Association.

LEWIS NIXON, Grymes Hill, S. I., N. Y., acting in the capacity of Superintendent of Public Works, has been appointed by Governor Smith, New York, as regulatory public service commissioner for New York, under the reorganization provided in bills passed recently by the legislature converting into a single-handed system the existing commission of five members. Mr. Nixon will resign his present office.

L. L. GODING, sales manager of the Peerless Electric Co., Warren, Ohio, was formerly district manager of the electric motor department for Fairbanks, Morse & Co., at Cleveland. In previous years he served as sales engineer to the Wagner Electric Manufacturing Co. at New York City, Fairbanks, Morse & Co., Chicago, American Rotary Valve Co., manufacturer of Jenney motors, Anderson, Ind., and Boston, Mass., and also the Century Electric Co., New York. Mr. Goding is an electrical engineer and a graduate of Platt Institute, Brooklyn, N. Y.

DONALD C. BARNES has succeeded A. L. Kempster as manager of the Seattle division of the Puget Sound Traction, Light & Power Co., the latter having resigned to accept a position in New York. Mr. Barnes formerly was manager of this company's traction and power interests at Everett, Wash., where George Newell becomes acting manager and W. E. Delano becomes superintendent of railways. Mr. Barnes is a Harvard graduate in electrical engineering, and has been active in electrical railway operations in the East, South and West since 1902. He is an associate member of American Instiute of Electrical Engineers.

Obituary.

CHARLES E. HUBBELL, Syracuse, N. Y., one of the organizers of the Syracuse & Suburban Railroad, and acting general manager of the company, died recently at his home, 1606 West Genesee street, following an attack of heart disease. Mr. Hubbell was 76 years of age.

ALEXANDER M. SCHOEPF, assistant chief engineer of the Cincinnati Traction Co., died at Christ Hospital, Ft. Mitchell, Ky., on May 4, following an operation for peritonitis. Mr. Schoepf came to Cincinnati 20 years ago from Washington, D. C. He is survived by his widow and two brothers, Lieut. Col. Theodore H. Schoepf, Pittsburgh, who recently returned from 21 months' service with the 15th Army Engineers, and W. Kesley Schoepf, president of the Cincinnati Traction Co.

For the Readjustment Period—What?

XXXVII.

Business Is Adjusting Itself

The interesting fact in connection with present business conditions is the fact that business is adjusting itself, industry by industry, to new conditions; and before we know it everything will be running at full tilt on a peace time basis. A few weeks ago the textile people thought that the bottom had dropped out of the textile business. Before anyone realized what was happening, women began to buy textiles in increasing quantities. Stocks were depleted, middlemen who had sold low found that they had sacrificed unnecessarily, and those who had refused to buy found that they must do a lot of scurrying about to find materials. And now the textile business seems to be running on high speed.

The same thing is being repeated in other lines. While waiting indefinitely for readjustment on prices, men in these various industries wake up and find that business is being done in spite of prices and everything else.

Two things stand out among others as responsible for this condition. One, of course, is the vast amount of financial resources in the country which, in spite of heavy taxation and war strain, has been augmented tremendously. The other can be attributed to the fact that, during the war, advertising was maintained throughout the country in such a thoroughbred manner. Merchants and manufacturers are cashing in on that advertising now because the public was not permitted to forget, even when production was away below demand, that advertising of worthy products was an important part of the news of the day, whether the products advertised could be obtained at the moment or not.

We have a right to be extremely optimistic as to the business outlook because we have not yet got a realization of our new power. Just as, after the Revolution, the inhabitants of our new country had no conception of that country's political and industrial potentialities; just as after the Civil War the people of the United States had no conception of the power which had come to a reunited country, so now that we have done a huge job, and done it well, we have not waked up to anything like an adequate conception of what the new era in business is destined to be. To picture it in words today would be to excite discredit as a visionary because we are not yet tuned to a realization of what the new opportunities mean.

Howard W. Dickinson, Vice-Pres.,
George Batten Company,
New York.

The above extract from a personal letter written by Mr. Dickinson to the undersigned is reproduced here for the reason that it has much more than individual interest. The facts stated by Mr. Dickinson are, or ought to be, an inspiration to the manufacturers of this country.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Public Utility Bond Situation.

The following is an excerpt from an article appearing in a recent issue of the Doherty News, discussing the present status of public utility bonds:

While there has been no improvement in market price but rather further decline in bonds of electric street and interurban railway companies, prices of bonds of corporations engaged in the artificial gas and electric light and power business have been making a fairly consistent advance in the last year, and while electric railway bonds probably average a lower market price than a year ago, gas and electric light and power bonds have made the best recovery in quotations of any class of corporation bonds.

Gas and electric bonds have shown as good advances in market prices as have those of high grade industrial companies while steam railroad bonds have suffered about the same fate as those of electric and interurban railways. The advance in bonds of good gas and electric light and power companies bears out the predictions made some months ago when investors were advised to purchase these bonds in preference to any other class of investment securities.

The changes in economic conditions due to the signing of the armistice have favorably affected all classes of public utility companies, with the exception that the ending of the great war has been of more benefit to artificial gas and electric light and power companies than to any other corporations in the country.

Under war conditions there were great and rapid rises in the cost of all items incident to the operation of artificial gas and electric light and power companies. All classes of fuel advanced to unprecedented quotations, and all kinds of maintenance material advanced in price anywhere from 50% to 200%. As a result of these conditions the ratio of operating expenses to gross earnings rose rapidly, and this, of course, materially reduced net earnings. Public utilities operating under fixed and non-elastic schedules of rates could not advance the price of their product to absorb the rising cost of operations, and while these companies were reporting the largest gross revenues in their history, there was a steady decline in net earnings owing to the steadily advancing operating ratio.

Relief in the way of increased rates was eventually given to many of these companies, but meanwhile a large part of the damage, so far as their securities were concerned, had been done, because of the long period that had to elapse between the becoming apparent of the necessity for an increase in rates to meet increased cost of operation and maintenance and the putting into effect of such increased rates.

There was another factor also which entered into war operation of public utilities, and one which most seriously affected economical operation and service of these companies. Labor costs advanced rapidly and the supply of efficient labor decreased almost as rapidly. It is probable that no industry in the country furnishes such a large percentage of its efficient and skilled labor to the service of the United States Government during the war as did the artificial gas and electric light and power companies.

Since the signing of the armistice and demobilization of the Army this is being changed and quite rapidly. Former employes are returning in large numbers, and while the cost of labor still remains abnormally high, the efficiency of such labor has been increased many per cent, and the effect of this return of trained and efficient men to the public utility properties is being shown by results of operation attained in the last few months.

At the same time the cost of many items essential to the maintenance and operation of public utility properties has declined, some of them almost to normal quotations. All this is now being reflected in statement of earnings of utility properties for the first quarter of 1919. Some proportion of the increase in gross revenue is now being saved for net revenues, and in one large group of public utility properties there was an increase of substantially 30% in net revenues in the first quarter of 1919 compared with the corresponding quarter of 1918.

It is these factors, operation of which were clearly foreseen by men in the artificial gas and electric light and power industries, which have caused the advance in the market price of bonds of these corporations. Market quotations in bonds of artificial gas and electric light and power companies will continue gradually to advance as net earnings of this class of utilities continue to show improvement in operating results throughout the coming months, and men familiar with conditions now existing, and who are best able to forecast the future of these industries are still advising investment in the securities of these corporations.

To the investor who is seeking safe and conservative bonds to which he can look for steady income and safety of principal, those of artificial gas and electric light and power companies should appeal, and appeal strongly. These companies have weathered the worst storm through which the public utility corporations of this country have ever been called upon to pass. They have come through the storm in good operating and financial condition, and are now rapidly approaching the net earning power which they had previous to the beginning of the storm. Their net earnings are again on the upward trend, and while to some extent this revival of earning power has been reflected on the quotations of their securities, yet it is far from having been fully reflected. There will be further advances in market quotations of these securities, and the far sighted investor will make his purchase now, and not wait until the time when with pre-war earning power fully returned and the bonds of these utility companies will again be selling on their pre-war income basis.

Wide Distribution of Utility Stocks and Bonds.

The following is a statement made by the Investment Bankers' Association of America concerning investment in bonds and stocks of public utilities:

"No class of securities is more widely distributed than the bonds and stocks of electric railways, gas and power and light, telephone and other public utility companies. The average holdings are small, and while very large amounts of utility securities are held by the insurance companies and savings banks, they are also distributed in the smallest denominations owing to a multitude of investors. More than $4,500,000,000 are invested in electric plants; nearly $5,000,000,000 in electric railways; $3,500,000,000 in gas plants; $1,500,000,000 in telegraphs and telephones and probably half a million more in equipment and supplies for these utilities in the hands of dealers—a total of $15,000,000,000 of the people's savings devoted to the conservation of energy in the public service."

Consolidation of Dakota Utilities Sought.

The Dakota Heat, Light & Power Co., a $3,000,000 corporation, which purposes to control the public utilities of 13 North Dakota towns and their environs, has applied to the State Railway Commission for an early hearing on the question of its proposed consolidation. In addition to its petition for a hearing, the corporation has filed with the commission a survey made by Hagenau & Erickson, engineers and accountants, Chicago, together with recommendations from this firm for the future operation and development of several of the plants which the Dakota Heat, Light & Power Co. purposes to take over.

WEEKLY COMPARISCN OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid May 6.	Bid May 13.
Adirondack Electric Power of Glens Falls, common	6	13	14
Adirondack Electric Power of Glens Falls, preferred	6	74	74
American Gas & Electric of New York, common	10+extra	119	148
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	275	266
American Light & Traction of New York, preferred	6	98	98
American Power & Light of New York, common	4	58	60
American Power & Light of New York, preferred	6	74	74
American Public Utilities of Grand Rapids, common	..	20	..
American Public Utilities of Grand Rapids, preferred	7	30	30
American Telephone & Telegraph of New York	..	103½	104⅛
American Water Works & Elec. of New York, common	..	5	4½
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	56	58
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	10	12
Cities Service of New York, common	+extra	365	382
Cities Service of New York, preferred	6	79⅛	79⅛
Commonwealth Edison of Chicago	8	111	111
Comm. Power, Railway & Light of Jackson, common	..	22	23
Comm. Power, Railway & Light of Jackson, preferred	6	48	50
Federal Light &Traction of New York, common	..	9	10
Federal Light & Traction of New York, preferred	..	46	46
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	35	35
Middle West Utilities of Chicago, preferred	6	60	60
Northern States Power of Chicago, common	..	70	70
Northern States Power of Chicago, preferred	ex.div.7	89	90
Pacific Gas & Electric of San Francisco, common	..	57	58
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	92	92
Public Service of Northern Illinois, Chicago, preferred	6	90	90
Republic Railway & Light of Youngstown, common	4	20	19
Republic Railway & Light of Youngstown, preferred	6	60	59
Standard Gas & Electric of Chicago, common	..	38	41
Standard Gas & Electric of Chicago, preferred	6	44½	48½
Tennessee Railway, Light & Power of Chattanooga, common	..	4½	4½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	19	19
United Light & Railways of Grand Rapids, common	4	40½	45
United Light & Railways of Grand Rapids, preferred	6	71	72
Western Power of San Francisco, common	..	17	19
Western Union Telegraph of New York	extra	87½	88
Industries.			
Electric Storage of Philadelphia, common	4	76	75
General Electric of Schenectady	8	164	163
Westinghouse Electric & Mfg. of Pittsburgh, common	7	48	55¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	56½	56½